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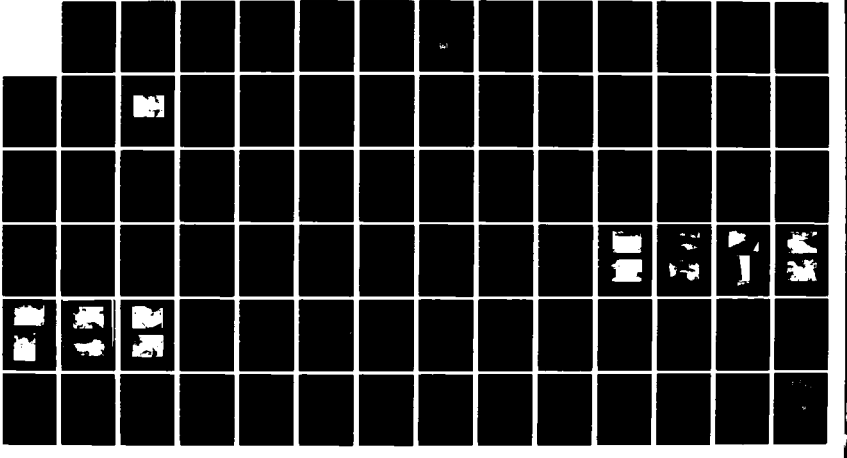
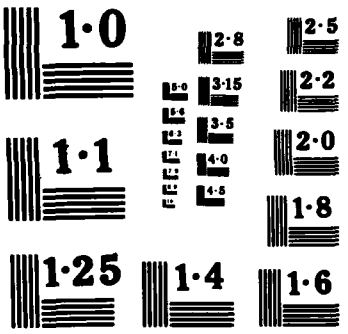


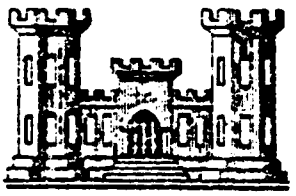


NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

MASSACHUSETTS–RHODE ISLAND COASTAL BASIN
NORTH ATTLEBORO, MASSACHUSETTS

WHITING POND DAM
MA 00859

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

DECEMBER 1978

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Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Massachusetts-Rhode Island Coastal Basin
North Attleboro, Massachusetts
Ten Mile River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is about 600 ft. long and has a maximum height of 9 ft. The dam is in fair condition. It is small in size with a hazard potential of high. Although some deficiencies were noted, there was no evidence of settlement lateral movement or other signs of structural failure or other conditions which would warrent urgent remedial action.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED-H

JUN 22 1979

Honorable Edward J. King
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts

Dear Governor King:

I am forwarding for your use a copy of the Whiting Pond Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrologic analysis. A brief assessment which emphasizes the inadequacy of the project spillway under test flood conditions is included at the beginning of the report.

The preliminary hydrologic analysis has indicated that the spillway capacity for the Whiting Pond Dam would likely be exceeded by floods greater than 8 percent of the Probable Maximum Flood (PMF), the test flood for spillway adequacy. Screening criteria for initial review of spillway adequacy specifies that this class of dam, having insufficient spillway capacity to discharge fifty (50) percent of the PMF, should be adjudged as having a seriously inadequate spillway and the dam assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to indicate the same degree of emergency as would be associated with "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening and preliminary computations there appears to be a serious deficiency in spillway capacity. This could render the dam unsafe in the event of a severe storm which would likely cause overtopping and possible failure of the dam, significantly increasing the hazard potential for loss of life downstream from the dam.

NEDED-E
Honorable Edward J. King

It is recommended that within twelve months from the date of this report the owner of the dam engage the services of a professional or consulting engineer to determine by more sophisticated methods and procedures the magnitude of the spillway deficiency. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed. During periods of unusually heavy preciptiation, round-the-clock surveillance should be provided.

I have approved the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the non-Federal Dam Inspection Program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. This report has also been furnished to the owner of the project, the Town of North Attleboro, Conservation Commission, 43 South Washington Street, North Attleboro, Massachusetts 02760.

Copies of this report will be made available to the public, upon request to this office, under the Freedom of Information Act, thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for the cooperation extended in carrying out this program.

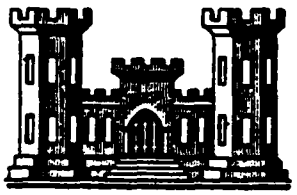
Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

MASSACHUSETTS–RHODE ISLAND COASTAL BASIN
NORTH ATTLEBORO, MASSACHUSETTS

WHITING POND DAM
MA 00859

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

DECEMBER 1978

MASSACHUSETTS - RHODE ISLAND COASTAL BASIN

NORTH ATTLEBORO, MASSACHUSETTS

WHITING POND DAM

MA 00859

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS 02154

DECEMBER 1978

PHASE I INVESTIGATION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No.:	MA 00859
Name of Dam:	Whiting Pond
Town:	North Attleboro
County:	Bristol
State:	Massachusetts
Stream:	Ten Mile River
Date of Site Visit:	4 October 1978

BRIEF ASSESSMENT

Whiting Pond Dam is approximately 600 ft. long, has a maximum height of 9 ft. and includes a 13-ft. long concrete spillway. Flashboards in the spillway are used to regulate the level of the pond for recreational purposes by the Town of North Attleboro. No information is available on the original design and construction. The embankment was reportedly raised one to two ft. and regraded in 1959 and the spillway area was repaired after a severe seepage problem developed under normal operating conditions in April, 1974. The pond has a maximum storage capacity of 211 acre-ft.

Due to the extent of downstream development that would be affected in the event the dam were to fail, Whiting Pond Dam is classified as having a "high" hazard potential in the Corps of Engineers National Inventory of Dams.

The dam is in fair condition, based on a visual examination of the structure. Although some deficiencies were noted, there was no evidence of settlement, lateral movement or other signs of structural failure or other conditions which would warrant urgent remedial action.

Based on size (small) and hazard (high) classifications in accordance with Corps of Engineers guidelines, the test flood for this dam is the Probable Maximum Flood (PMF). The PMF outflow of 4160 cfs (1015 csm) would overtop the spillway platform by about 2.6 ft. and most of the embankment by 1 to 1.5 ft. With the water at the level of the platform, the spillway (without flashboards) can pass 312 cfs which is 7.5 percent of the test flood.

The Town of North Attleboro, owner of the dam, should engage a registered professional engineer to determine what alternative measures are required to significantly increase the discharge capabilities of the dam. In addition, surveys of the embankment and an investigation of possible seepage at the downstream end of the spillway should be made as outlined in Section 7.2. The results of these investigations and

remedial measures, including removal of brush and selected trees from the embankment, rehabilitating the downstream end of the spillway and monitoring the area for seepage, restoring the reservoir drain to operating condition and other maintenance work as outlined in Section 7.3, should be implemented by the owner within one year after receipt of this report.

HALEY & ALDRICH, INC.
by:

Harl Aldrich
President

This Phase I Inspection Report on Whiting Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, DC 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm run-off), or a fraction thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does <u>not</u> include an assessment

of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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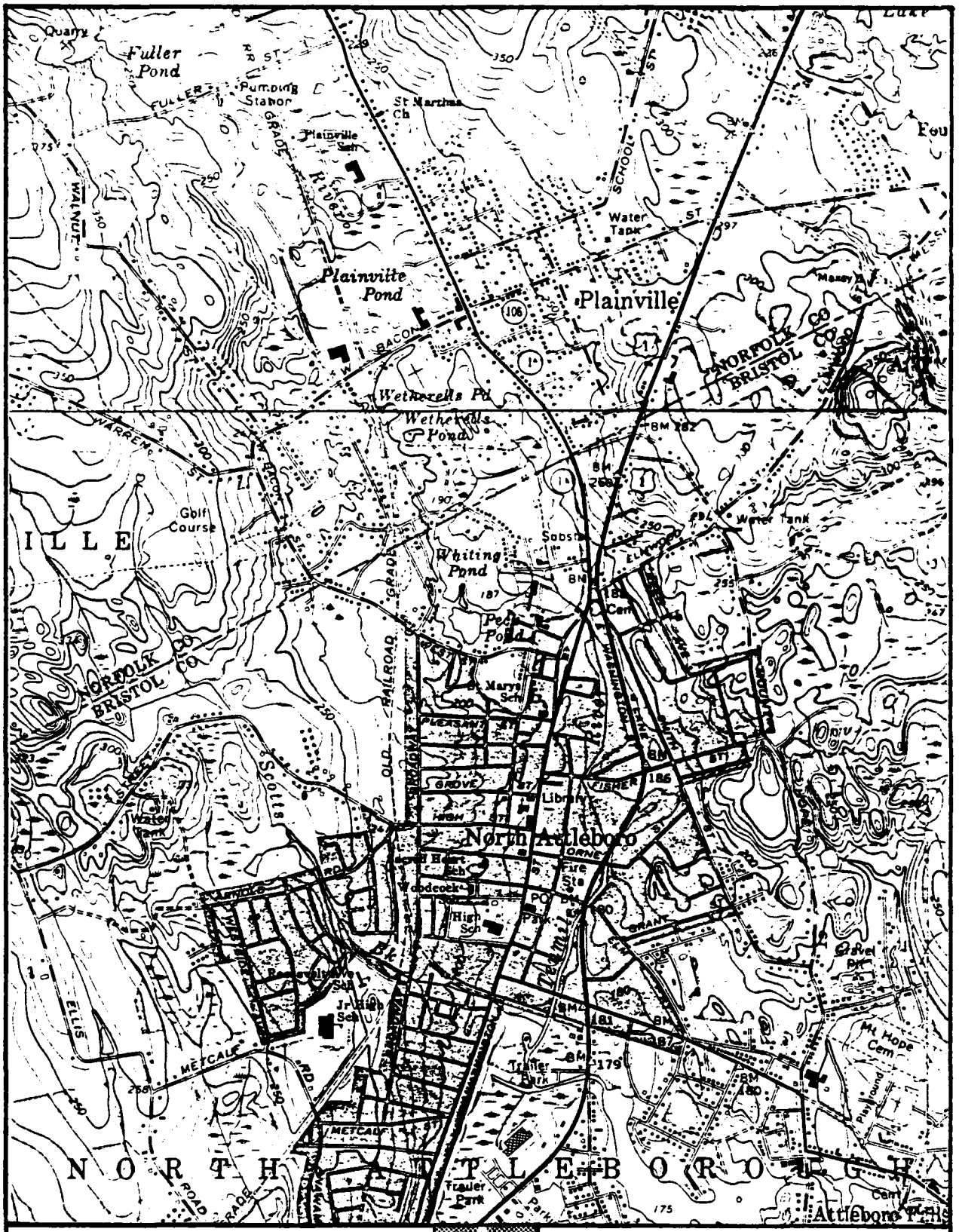
1. Upstream face of Whiting Pond Dam spillway structure



FILE NO. 4160 A24

DAM: Whiting Pond

IDENTIFICATION NO. MA 00859

N

LOCATION MAP

USGS QUADRANGLE

ATTLEBORO, MA.

APPROX. SCALE: 1"= 2000'

PHASE I INVESTIGATION REPORT
NATIONAL DAM INSPECTION PROGRAM
WHITING POND DAM
MA 00859

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

A. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

Haley & Aldrich, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed were issued to Haley & Aldrich, Inc. under a letter dated 26 April 1978 from Colonel Ralph T. Garver, Corps of Engineers. Contract No. DACW33-78-C-0301 has been assigned by the Corps of Engineers for this work. Camp, Dresser & McKee, Inc. was retained as consultant to Haley & Aldrich, Inc. on the structural, mechanical/electrical and hydraulic/hydrologic aspects of the Investigation.

B. Purpose. The primary purposes of the National Dam Inspection Program are to:

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

2. Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

3. To update, verify and complete the National Inventory of Dams.

1.2 PROJECT DESCRIPTION

A. Location. The dam is located at the southeast corner of Whiting Pond in North Attleboro, MA as shown on the Location Map, page viii. Discharge from the dam is conveyed by the Ten Mile River southward for ten miles to its confluence with the Seekonk River which joins the Providence River in Providence, R.I.

B. Description of Dam and Appurtenances. The Whiting Pond dam consists of a small earth embankment and a concrete spillway structure with provisions for flashboards. The total length of the dam is approximately 600 ft. The "Site Plan Sketch", Appendix C-1, shows the general configuration of the dam and appurtenances.

The embankments are approximately 9 ft. above streambed but generally less than 4 ft. above adjacent ground surface with no discernible crest. The embankment which extends approximately 540 ft. right from the spillway has roughly 2 horizontal to 1 vertical slopes both upstream and downstream. The left embankment is approximately 50 ft. in length to the end of a low stone masonry wall.

The broad-crested concrete spillway is 13 ft. long with a crest, estimated at El. 187, 4.2 ft. below the adjacent concrete platform. Two flashboards totaling 2.1 ft. in height were in place. A row of wood-plank sheeting was driven beneath the upstream end of the spillway and adjacent concrete walls.

A 12-in. reservoir drain pipe is present left of the spillway. The valve and operator stem are buried behind the left entrance channel wall. The intake end is below pond level and discharge is through the left downstream channel wall.

A concrete intake structure is located about 250 ft. right of the spillway. This intake is covered by a chain link fence, has provisions for flashboards, and feeds two pipes of 6-in. and 8-in. diameter, respectively. Controls for the pipes are located on the downstream slope of the embankment.

C. Size Classification. The storage to the top of Whiting Pond Dam is estimated to be 211 acre-ft., and the maximum height of the dam is approximately 9 ft. Storage of less than 1000 acre-ft. and a height of less than 40 ft. classifies the dam in the "small" category according to guidelines established by the Corps of Engineers.

D. Hazard Classification. The dam is currently classified as having a "high" hazard potential in the Corps of Engineers National Inventory of Dams. Dam failure analysis computations,

Appendix D-12, which are based on "Guidance for Estimating Downstream Dam Failure Hydrograph" confirm this classification. In the event of a dam failure, a multitude of structures downstream of the dam would be flooded and there would likely be loss of life. More specifically, the Sterndent Corporation complex, the Town's power transmission station, a large number of residential and commercial structures surrounding the dam and in the center of the Town, as well as a school would experience a high degree of flooding.

E. Ownership. The name and address of the current owner is:

Town of North Attleboro
Conservation Commission
43 S. Washington Street
North Attleboro, MA 02760

The dam and pond were purchased by the current owner for $1 from the Blackington Corp., North Attleboro, MA in 1959. The former owners chose to sell the property rather than perform the required repairs to the dam.

F. Operator. Mr. Hugh L. Donnelly, Chairman of the North Attleboro Conservation Commission, is responsible for operation, maintenance and safety of the dam.

G. Purpose of Dam. The dam retaining Whiting Pond is used soley for recreational purposes by the Town of N. Attleboro. Prior to 1960, water was drawn from the pond for industrial processes.

H. Design and Construction History. No plans or other records were available to provide information on the original construction of the dam. It is believed that a dam was first built at the site to provide water power for a factory before 1900.

Drawings by James E. Munroe, Sr. indicate that the embankment was reportedly raised and the spillway modified to insert flashboards in 1959 by the current owner.

The dam was reported to be leaking severely adjacent to and under the spillway slab in April 1974. The pond was immediately drawn down and repairs were made during the following 8 months. There is a set of twenty photographs that show some details of the repairs, but there are no design or other construction records. The repairs were made by Mr. Robert Razee, a local contractor, based upon his engineering judgement and construction experience.

I. Normal Operational Procedures. There is no written procedure for the operation of the dam. Generally, flashboards are installed only during the summer months to raise the reservoir

level. The flashboards are lowered at times of high flow and are removed every fall. The outlet drain has never been operated. It would require a diver to remove a cover over the intake end of the pipe.

1.3 PERTINENT DATA

In the absence of plans of the dam showing a specific elevation datum, the water surface elevation of 187 (MSL) shown on the USGS "Attleboro, Mass. - R.I." quadrangle dated 1964 was assumed to be the elevation of the spillway crest (with no flashboards in place).

A. Drainage Area. The drainage area of Whiting Pond is an estimated 4.10 square miles (2624 acres). The water surface area of the pond occupies approximately 0.7 percent (19 acres) of the total drainage area. The watershed consists primarily of wooded areas with rolling terrain dominating the eastern and western sectors. A map of the drainage area is included in Appendix D-1.

The principal watershed is that of the Ten Mile River which forms about 2-1/2 miles north of Whiting Pond in neighboring Plainville and flows in a south-southeasterly direction passing through Cargill Pond, Fuller Pond and Plainville Pond before entering Wetherell's Pond. There are, however, small marshland and ponding areas along the Ten Mile River watercourse 1/4 to 1/2 mile west of Route 1A. The major developed portions of the watershed are along and adjacent to Route 1A, particularly the downtown section of Plainville to the east of Route 1A along Route 106.

There are two outlets from the southerly side of Wetherells Pond. The easterly one parallels Route 1A about 500 to 600 ft. west of it and conveys the Ten Mile River flows toward the center of North Attleboro. The westerly outlet is about 1/8 mile west of the easterly outlet and conveys flow southerly for about 1/4 mile into Whiting Pond. About 500 ft. upstream of where flow from this westerly outlet enters Whiting Pond, an east-west feeder stream joins conveying flow from the Ten Mile River toward Whiting Pond. This stream acts as a balancing channel with the major portion of flow travelling west and into Whiting Pond while the lesser portion continues to flow southerly into North Attleboro on the diminished Ten Mile River channel.

B. Discharge at Dam Site

1. Outlet Works.....	12-in. pipe with discharge invert at approx. El.182.5
2. Maximum known flood at dam site.....	Unknown

3. Ungated spillway capacity at top of dam	310 cfs at El. 191.2
4. Ungated spillway capacity at test flood pool elevation	651 cfs at El. 193.8
5. Gated spillway capacity at normal pool elevation	Not applicable
6. Gated spillway capacity at test flood pool elevation	Not applicable
7. Total spillway capacity at test flood pool elevation	651 cfs at El. 193.8
8. Total project discharge at test flood pool elevation	4160 cfs at El. 193.8

C. Elevation (ft. above MSL)

1. Top dam	191.2 (Top of concrete platform adjacent to spillway)
2. Test flood pool-design surcharge	193.8
3. Design surcharge - original design	Unknown
4. Full flood control pool	Not applicable
5. Spillway crest (with flashboards)	189.1
(without flashboards)	187.0
6. Upstream portal invert diversion tunnel	Not applicable
7. Streambed at centerline of dam	182.4
8. Maximum tailwater	Unknown

D. Reservoir

1. Length of maximum pool	0.60 miles
2. Length of recreation pool	0.30 miles

3. Length of flood control pool..... Not applicable

E. Storage (acre-feet)

1. Top of dam	211
2. Test flood pool	418
3. Flood control pool	Not applicable
4. Recreation pool	29
5. Spillway crest	29

F. Reservoir Surface (acres)

1. Top of dam	67
2. Test flood pool	92
3. Flood control pool	Not applicable
4. Recreation pool	19
5. Spillway crest	19

G. Dam Embankment

1. Type	Earth
2. Length	600 ft. (Est.)
3. Height	9 ft. above streambed
4. Top width	About 3-4 ft. (No apparent crest)
5. Side slopes	Varies; 2H to 1V and steeper right of spillway; some gently sloping lawns left of spillway
6. Zoning	Unknown
7. Impervious core	Unknown
8. Cutoff	Wood plank sheeting beneath upstream end of spillway and adjacent concrete walls only
9. Grout curtain	Unknown
10. Other	Crest was raised and slopes regraded in 1959

H. Diversion and Regulating Facilities. Not applicable.

I. Spillway

1. Type	Broad-crested concrete
2. Length of weir	13.0 ft.
3. Crest elevation	187
4. Gates	None (two flashboards in place total 2.1 ft. in height)

5. U/S channel..... Unknown
6. D/S channel..... Approx. 0.6 percent slope
7. General..... Repaired in 1974

J. Regulating Outlets. The normal method for regulating flow from Whiting Pond is by inserting or removing flashboards within the spillway. The length of area capable of receiving flashboards is approximately 13 ft. The spillway crest is approximately at El. 187 without the use of flashboards. 12-inch high flashboards are normally installed. During normal flows and at the time of the site examination, two flashboards totaling approximately 24 in. in height were in use. The operator of the dam indicated that flooding does occur when a third flashboard is installed.

A reservoir drain is located in the spillway area. Only the outlet end of this pipe is exposed to view. The drain appears to be a 12-in. diameter pipe with discharge invert at approximately El. 182.5. It is reported that the inlet end of the pipe presently has a cap over it. This cap must be removed by diver prior to operation of the drain. The control valve for the pipeline is buried behind the left entrance channel wall. The location is marked by a box out in the concrete slab behind this wall. Due to the presence of the cap over the inlet and the buried operating stem, it appears that the reservoir drain could only be utilized during planned dewatering of the reservoir.

An intake structure is located approximately 250 ft. right of the spillway. It is reported that this structure feeds a 6-inch and an 8-inch pipeline to the mill below the dam. Valves on each of these lines are located downstream of the dam embankment. Invert elevations on these pipelines are unknown.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN RECORDS

The only design records available for the dam are a set of four drawings entitled "Dike and Spillway Alterations" by Mr. James E. Munroe, Sr. The drawings are undated but are reported to have been prepared in 1959.

No design records of the 1974 repairs performed by Mr. Razee are available or believed to exist.

2.2 CONSTRUCTION RECORDS

The 1959 plans previously described are the only record of the construction work performed that year.

A set of twenty photographs is the only record of the repairs performed in 1974.

2.3 OPERATION RECORDS

No records pertaining to the operation of the Whiting Pond Dam were located and none are believed to exist.

2.4 EVALUATION

A. Availability. A list of all engineering data available for use in preparing this report is included in Appendix B-1. Selected documents from the listing are also included in Appendix B.

B. Adequacy. A review of design and construction data is a highly desirable factor in developing a thorough Phase I assessment. However, there were insufficient engineering data available for this dam to allow for such a review. The evaluation of the dam is therefore based primarily on visual inspection, past performance and engineering judgement.

C. Validity. The drawings by Mr. James Munroe, Sr. for the spillway structure, should no longer be considered valid because the spillway was altered in 1974. Some changes in embankment geometry have also occurred, especially left of the spillway. There is no reason to doubt the validity of the other available engineering data.

SECTION 3 - VISUAL EXAMINATION

3.1 FINDINGS

A. General. The Phase I visual examination of the Whiting Pond dam was conducted on 4 October 1978.

In general, the project was found to be in fair condition, based particularly on deficiencies noted in the stone masonry wall on the downstream end of the spillway which require correction.

A visual inspection check list is included in Appendix A and selected photographs of the project are given in Appendix C. A "Site Plan Sketch", Appendix C-1, shows the direction of view of each photograph.

B. Dam. The long earth embankment to the right of the spillway goes behind the Cooke-Horton Division of the Sterndent Corporation. A locked chain-link fence runs along the top of the embankment. Mr. Charles Vesper opened a gate in the fence to allow access to examine the embankment. The embankment is estimated to be about 3 or 4 ft. in height above the water level with no discernible flat crest. For the most part the embankment is covered with grass, weeds and small saplings. However, some large trees as much as 24 to 30 in. in diameter have grown on the slopes. There is some evidence of erosion and sloughing on the upstream slope, but the embankment appears to be at least 1 ft. higher than the top of the concrete platform at the spillway.

On the downstream side of the dam immediately right of the spillway, the earth embankment is retained by a dry laid stone rubble wall which is in a state of collapse, Photo No. 2. Some erosion of the earth fill has occurred in one 5-ft. wide section which in fact has collapsed. There was no seepage noted at the toe of this area which represents the highest part of the earth embankment.

The 50-ft. long section of embankment left of the spillway has a crest elevation approximately 6 to 12 in. above the concrete platform adjacent to the spillway. The embankment is covered by grass which has been mowed and there is one 12-in. pine and several 6 to 8 in. birch trees. There has been a little erosion around the base of the birch trees and part of the area has been backfilled with wood chips. It is understood that the stone masonry wall located immediately left of the spillway was constructed in 1974.

However, the embankment beyond that point was not altered. There are boulders at the water line of the pond shoreline, where it appears there was a shallow stone wall behind which the earth was placed. There is some deterioration of the wall and the undermining of the stone by wave action, but there is no danger to the embankment. This area is shown in Photo No. 3.

C. Appurtenant Structures. The upstream portion of the spillway walls and the adjacent platform are constructed of relatively recent vintage concrete and are in excellent to good condition, Photos No. 4 and 5. There are some minor shrinkage cracks present within the concrete. The concrete joints were either not sealed or the sealant has been lost. Sealants are required at these joints to prevent future deterioration of the structure. A trash screen constructed of chain-link fencing spans the approach channel.

The spillway walls from the area of the flashboards to the downstream end of the spillway platform are constructed of concrete of an older vintage, Photo No. 6. A wooden plank bridge over the spillway is bolted to these walls. The planks are in need of painting and some of the anchor bolts are in need of washers and nuts. The old concrete wall on the left side downstream of the flashboards appears to have tilted, opening an approximately 3/8-in. gap in the top, Photo No. 7.

An open-jointed masonry wall supports the downstream end of the spillway, Photos No. 8 and 10. The wall contains a number of voids in which probes could be inserted several feet. One such void in this wall extends under the left concrete spillway wall as shown in Photo No. 9. The void was probed to a depth of 8 ft. and thus believed to be responsible for the wall above to tilt as previously described. Note the 6-ft. ruler shown in Photo No. 11 which was inserted 5 ft. into a void on the right side of the masonry wall before encountering an obstruction.

Apparently a number of voids in this wall were created by lost stones. There is vegetation in the joints on both sides of the spillway and indications of possible seepage. However, the presence of water from discharge over the spillway flashboards precluded an absolute determination that the observed moisture was due to seepage. The stone masonry is overhanging its foundation in the area of contact with the right downstream channel wall and appears to be unstable, Photos No. 10 and 11. However, no indication of recent movement was observed.

The outlet to the 12-in. reservoir drain pipe is shown in Photo No. 8. This drain has never been operated. Since the intake end of the pipe is capped and the gate operator is buried, it is doubtful that the drain could easily be operated on demand.

An intake structure is located about 250 ft. right of the spillway, Photo No. 12. This intake is constructed of concrete and covered by a chain link fence. The concrete is in good condition. The chain link fence is in good condition and well maintained. The structure has provisions for 2 sets of stoplogs. The left guide for the upstream stoplog position has broken off near the top. The gate valve boxes for the pipelines leading from the inlet structure are on the downstream slope of the dam. Although vegetation and debris are adjacent to the gate valve boxes, they are exposed to view and accessible. However, this intake is no longer used and plans have been made to block the outlet with concrete.

D. Reservoir Area. The area around Whiting Pond is generally wooded with what appears to be sandy gravel slopes, some of which are bare from erosion by rainfall and foot traffic. While some of the slopes are relatively steep, there is no apparent danger of slides into the reservoir or a significant erosion potential. There are a number of homes having lawns which come down to the edge of the water. These area generally occur around the reservoir to the left of the spillway, as can be seen in Photo No. 13.

Sedimentation is occurring steadily at Whiting Pond. The Town of North Attleboro is currently seeking funding to dredge the pond.

E. Downstream Channel. The downstream channel from Whiting Pond dam has a natural ground invert and stone masonry side walls, Photos No. 14 and 15. The area adjacent to the walls is vegetated and well maintained. Individual trees border the downstream channel. Minor debris in the form of broken rock is present in the channel invert. Nevertheless, the channel is generally unobstructed and in good condition.

3.2 EVALUATION

Although portions of the dam are in excellent to good condition, the general condition of the dam can only be considered fair due to the voids, possible seepage and unstable appearance present at the masonry wall on the downstream end of the spillway.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

No written operational procedures exist for the Whiting Pond dam. Flashboards at the spillway are inserted or removed by members of the North Attleboro Conservation Commission based on visual observations of the amount of flow over the spillway. In general, the flashboards are only in place during the summer months. The dam is reportedly observed during periods of high flow and/or unusually high rainfall.

4.2 MAINTENANCE OF THE DAM

The owners have no established formal maintenance program for the dam. Maintenance is performed on the basis of need and the availability of funds.

4.3 MAINTENANCE OF OPERATING FACILITY

The flashboards are maintained before inserting them after winter storage each year.

The reservoir drain is capped and underwater at the intake end and the operating gate is buried. Due to these conditions, it is estimated that this drain could not be operated during time of emergency and would only be operated during a planned dewatering of the reservoir.

The two pipelines from the intake structure right of the spillway are in good condition and indications are that they have received good maintenance. However, there are no formal maintenance procedures known for this structure.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

There is no formal warning system or emergency preparedness plan in effect for this dam. The dam is reportedly observed by the owners during periods of high flow and/or usually high rainfall and flashboards are removed on the basis of their judgement.

4.5 EVALUATION

For a structure of this type and classification, a biennial observation and maintenance program should be established to examine the dam, control vegetation growth and maintain slopes, walls and channels. A formal procedure should be established for the insertion and removal of flashboards. Incorporated in this procedure should be a procedure to operate the reservoir drain periodically. A written warning system or emergency preparedness plan should also be established.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

A. Design Data. A set of plans entitled "Dike and Spillway Alterations, Whiting Pond Dam, Broad-Whiting Streets" were the basis for alterations on the dike and spillway. These plans were prepared by James E. Munroe, Sr. However, neither hydraulic nor hydrologic design data were found.

The recommended test flood for the size (small) and hazard potential (high) of this dam is in the range of the one-half probable maximum flood (1/2 PMF) to the probable maximum flood (PMF).

B. Experience Data. According to a 1965 inspection report, "Overtopping was reportedly avoided in 1955 by placing sandbags on embankment. Some damage, however, from flooding of Mud Hole Brook on south side of mill", Appendix B-2. This was the earliest engineering data available.

Mr. Hugh L. Donnelly, Chairman, North Attleboro Conservation Commission, reports that "Whiting Pond Dam became dangerously unsafe due to undermining the earthen portion of the dam" during normal flow conditions in April 1974. "Fortunately, it was discovered in time, before a serious flood problem developed. Emergency was declared" and repairs intended to eliminate seepage under and adjacent to the spillway were implemented within the following 10 months.

Because of the small magnitude of the drainage area, the "SCS TP-149 Method for Estimating Volume and Rate of Runoff in Small Watersheds" was used as a guide for determining the inflow hydrograph into Whiting Pond for the PMF. The PMF was based on a rainfall of 24 inches in 6 hours. The peak inflow generated from the entire watershed is 4730 cfs. By taking advantage of surcharge storage, this value is reduced to 4160 cfs at a maximum water surface of El. 193.8 (ft. above MSL).

C. Visual Observations. On the day of the inspection, two wooden flashboards were in place with an approximate depth of 1.25 in. of water going over the boards. Immediately downstream of the spillway, the channel is covered by small boulders, with some brush and assorted debris. This condition, however, improved almost immediately downstream of the point where the

chain-link fence crosses the channel approximately 20 feet downstream of the spillway. The channel has a silted bottom with small stones, a width of 11 ft. and a slope of less than 1 percent. It is also lined with mortared stone walls which vary in height from 28 in. to 42 in. as one proceeds downstream.

Approximately 120 ft. downstream of the dam, a concrete box culvert 3.3 ft. in height and 11 ft. in width conveys the flow beneath the access road which leads to the loading area of the Sterndent Corporation. For the next 280 ft., the flow is again in a 15-ft. wide, stone-lined channel. At the end of this channel section, the flow is conveyed beneath Broad Street by an open-jointed stone culvert 15 ft. in width, 2.5 ft. in height, with a 2-ft. wide center pier. About 200 ft. downstream of Broad Street this flow joins the Ten Mile River channel and is conveyed in a stone-lined channel (14 ft. in width) with a slope of less than 1 percent for approximately 800 ft. to the intersection of Route 1A.

Flow is conveyed under Route 1A for an estimated 100 ft. by another concrete box culvert 14 ft. in width and 3.33 ft. in height. Beyond this point, the Ten Mile River continues to wind its way through a densely developed residential and commercial section of North Attleboro and eventually flows into Falls Pond at Attleboro Falls.

D. Overtopping Potential. As stated previously, the test flood for Whiting Pond is in the range of 1/2 PMF to the PMF. Because of the proximity of residential structures to the toe of the dam, the test flood is designated to be the PMF. With the water level at the top of the spillway platform, the spillway can pass 312 cfs which is 7.5 percent of the test flood inflow of 4160 cfs. If the PMF were to occur, the spillway platform would be overtopped by about 2.6 ft. Most of the embankment would also be overtopped by 1 to 1.5 ft.

E. Evaluation. The spillway is not capable of passing the test flood without overtopping the dam. If a breach of the dam was to occur, it would result in widespread major flooding in the downstream reaches of the outlet channel and the Ten Mile River. The homes on the left side of the first reach of the stone-lined channel system, as well as the Sterndent Corporation complex and parking lots, the town's power transmission station and a school would be seriously damaged by floodwaters. The commercial structures in the more densely developed portion of town (surrounding the junction of Washington Street and East Washington Street) would also experience a major degree of flooding. The flooding of such a large tract of the town would result

in not only large economic losses from damage to residential, industrial and commercial properties but also there would very likely be loss of life.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF EMBANKMENT STRUCTURAL STABILITY

A. Visual Observations. No riprap was present on the upstream slope of the embankment. Erosion of the right embankment has occurred due to foot traffic and rainfall. A collapsing stone wall was noted right of the spillway on the downstream side. There was no apparent evidence of unusual embankment seepage or structural instability on 4 October 1978, although the presence of brush and numerous trees precluded close examination.

B. Design and Construction Data. The configuration of the embankment prior to changes made in 1959 are shown on the James E. Munroe, Sr. drawings. The upstream slopes were generally flatter and appeared to have been eroded somewhat. There was no specification in the drawings for placing riprap on the upstream slopes.

There are no records available to indicate the design or construction details of the original embankment.

C. Operating Records. Prior inspection reports, Appendix B-2 and B-3, indicate that the embankment was nearly overtopped in 1955 and actually has been overtopped in the past. There is no field instrumentation or reports to indicate settlement, lateral movement or other information about the embankment.

D. Post-Construction Changes. The cross-section of the embankment was modified in 1959. Apparently the crest was raised by one to two feet with granular soil, and slopes were designed to be 2 horizontal to 1 vertical on either side of a 3-ft. wide crest. Homeowners left of the spillway apparently have placed backfill on property adjacent to the pond to about the level of the top of the embankment.

E. Seismic Stability. This dam is located in Seismic Zone 2 and in accordance with Recommended Phase I guidelines does not warrant a seismic analysis.

6.2 EVALUATION OF SPILLWAY STRUCTURAL STABILITY

A. Visual Observations. With the exception of the left spillway wall downstream of the flashboards and the stone masonry wall at the downstream end of the spillway, there was no visual evidence of movement or distress in the spillway. However, failure of these walls would not result in a breach of the dam at the spillway.

B. Design and Construction Data. A theoretical structural analysis of the spillway was not possible due to the lack of pertinent data. Photographs of the 1974 renovation of the spillway entrance were viewed. Based on the height of the spillway entrance and the type of construction indicated by the photographs, it is estimated that the portion of the spillway from the entrance to the spillway flashboards is structurally stable.

C. Operating Records. No operating records are known to exist for the spillway.

D. Post-Construction Changes. The spillway has been altered apparently a minimum of 2 times. Undated plans showing the removal of a spillway weir were located. These plans are not consistent with the spillway currently in place. In addition, the entrance to the spillway was altered in 1974. This alteration consisted of removing the entrance of the prior spillway, the installing of a timber sheet pile cutoff, the construction of new entrance walls, floor slab and flashboards.

E. Seismic Stability. This dam is located in Seismic Zone 2 and in accordance with Recommended Phase I guidelines does not warrant a seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM ASSESSMENT

A. Condition. The visual examination of Whiting Pond dam revealed that the structure was in fair condition. Although there were no signs of structural failure or other conditions which would warrant urgent remedial action, several deficiencies were noted.

Based on the results of computations included in Appendix D and described in Section 5, the spillway is not capable of passing the test flood, which for this structure is the PMF. The PMF outflow of 4160 cfs (1015 csm) would overtop the spillway platform by about 2.6 ft. Most of the embankment would also be overtopped by 1 to 1.5 ft. With the water level at the top of the spillway platform, the spillway can pass 312 cfs which is 7.5 percent of the test flood.

B. Adequacy of Information. A review of design and construction data is a highly desirable factor in developing a thorough Phase I assessment. However, there were insufficient engineering data available for this dam to allow for such a review. The evaluation of the dam is therefore based primarily on visual inspection, past performance and engineering judgement.

C. Urgency. The recommendations for additional investigations and remedial measures outlined in Sections 7.2 and 7.3, respectively, should be undertaken by the Owner and completed within one year after receipt of this report.

D. Need for Additional Investigations. Additional investigations should be performed by the Owner as outlined in Section 7.2.

7.2 RECOMMENDATIONS

It is recommended that the Owner engage a registered professional engineer to undertake the following investigations:

1. Hydrologic/hydraulic studies to determine what alternative measures are required to significantly increase the discharge capabilities at the dam.

2. Surveys to determine cross-sections for the existing earth embankment right of the spillway to determine

need for earth fill to restore embankment where it does not meet required grades and slopes.

3. Determine if seepage is occurring at the downstream end of the spillway, and if so, recommend additional remedial measures to be performed in conjunction with those outlined in Section 7.3A, Item 2.

7.3 REMEDIAL MEASURES

Although the dam is generally maintained in good to fair condition, it is considered important that the following items be accomplished:

A. Operation and Maintenance Procedures. The following remedial work should be undertaken by the Owner:

1. Remove brush and selected trees from the embankment right of the spillway. If trees are not removed, a major windstorm or hurricane may uproot trees leading to a breach in the embankment. Periodically observe what effect, if any, the clearing and deterioration of root systems has on the embankment.

2. Rehabilitate the spillway from the flashboards to the downstream channel. This includes the filling of all voids beneath the spillway invert slab, beneath the spillway sidewalls and behind the spillway end wall. It will require the anchoring of the left concrete spillway wall to the adjacent slab or embankment. All vegetation growing in the downstream stone masonry wall should be removed during this work. An alternate to this work would be to rebuild the downstream end of the spillway.

3. Monitor the downstream end of the spillway for evidence of seepage.

4. Remove the cap from the intake end of the reservoir drain and expose the operating shaft on the reservoir drain valve stem. A metal cover may be placed over the valve stem to minimize vandal damage.

5. Clean and seal all joints in the spillway concrete.

6. Repaint the walkway over the spillway and replace all missing anchor bolt washers and nuts.

Because the dam is classified as having a "high" hazard potential, the Owner should prepare an operations and maintenance manual for the dam. The manual should include

provisions for biennial technical inspection of the dam and for surveillance of the dam during periods of heavy precipitation and high reservoir water levels. The procedures should delineate the routine maintenance work to be done on the dam to ensure satisfactory operation and to minimize deterioration of the facility. Responsibility for the program should be assigned to one person.

A formal procedure based on reservoir level and flow should be established for the insertion and removal of flashboards. Incorporated in this plan should be the point at which the reservoir drain should be operated to increase discharge flows from the reservoir.

The Owner should also develop a written emergency preparedness plan and warning system to be used in the event of impending failure of the dam. The plan should be developed in cooperation with local officials and downstream inhabitants.

7.4 ALTERNATIVES

Not applicable.

APPENDIX A
INSPECTION TEAM ORGANIZATION AND CHECK LIST

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

Dam: Whiting Pond Dam

Date: 4 October 1978

Time: 0840-1115

Weather: Partly Cloudy and Cool

Water Surface Elevation Upstream: 189.2 (2.0 ft. below top of concrete platform at spillway)

Stream Flow: Not Known

Inspection Party:

Harl P. Aldrich, Jr. Haley & Aldrich, Inc.	-	Soils/Geology
Roger H. Wood Camp, Dresser & McKee, Inc.	-	Structural
Charles E. Fuller Camp, Dresser & McKee, Inc.	-	Hydraulic/Hydrologic

Present During Inspection:

Hugh L. Donnelly, Chairman, N. Attleboro Conservation Commission
Frank McCormack, N. Attleboro Conservation Commission
Richard A. Brown, Haley & Aldrich, Inc.
Donna L.B. D'Amore, Camp, Dresser & McKee, Inc.

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Whiting Pond Dam DATE: 4 Oct. 78

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	Varies. Top of dam assumed to be concrete platform adjacent to spillway at El. 191.2. The embankments appear to be about 1 to 1.5 ft. higher.
Current Pool Elevation	189.2 (2.0 ft. below top of concrete platform at spillway)
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed
Pavement Condition	No pavement
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	Some variation noted, believed to be small
Horizontal Alignment	Not applicable (alignment is irregular)
Condition at Abutment and at Conerete Structures	Generally satisfactory except for some erosion.
Indications of Movement of Structural Items on Slopes	Not applicable
Trespassing on Slopes	Trespassing on crest and upstream slope restricted by chain link fence; trespassing can occur on downstream slope
Animal Burrows in Embankment	None observed
Vegetation on Embankment	Grass, brush and numerous trees, some of which are large
Sloughing or Erosion of Slopes or Abutments	Erosion by foot traffic and rainfall noted; Stone wall on downstream side, right of spillway, has failed (See text and photos)
Rock Slope Protection - Riprap Failures	No riprap
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Whiting Pond Dam DATE: 4 Oct. 78

AREA EVALUATED	CONDITION
Piping or Boils	None observed
Foundation Drainage Features	Unknown (probably none)
Toe Drains	Unknown (probably none)
Instrumentation Systems	None
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good
Loose Rock Overhanging Channel	None
Trees Overhanging Channel	None
Floor of Approach Channel	Not visible
b. Weir and Training Walls	
General Condition of Concrete	Good - Left wall downstream of flashboards appears to have tilted inward 3/8 of an inch
Rust or Staining	None observed
Spalling	No major spalls observed
Any Visible Reinforcing	None visible
Any Seepage or Efflorescence	Seepage at stone masonry wall downstream. Very small spots of efflorescence on concrete
Drain Holes	None observed
c. Service Bridge	
Bearings	None
Anchor Bolts	Good condition but a number of nut and washers missing
Bridge Seat	Spillway walls
Longitudinal Members	3 planks in good to fair condition
Under Side of Deck	Not applicable
Secondary Bracing	Not applicable
Deck	See longitudinal members
Drainage System	Free draining

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Whiting Pond Dam DATE: 4 Oct. 78

AREA EVALUATED	CONDITION
Railings	None
Expansion Joints	Not applicable
Paint	Needs painting
Abutment and Piers	No piers; abutments are walls of spillway
d. Discharge Channel	
General Condition	Good
Loose Rock Overhanging Channel	Channel walls are of stone masonry. Stones mortared in place adjacent to spillway and open joints downstream
Trees Overhanging Channel	Several trees are present on each side of channel
Floor of Channel	Gravel with a scattering of broken rock. Presence of broken rock more pronounced at start of channel
Other Obstructions	Chain link fence with hinged bottom positioned in channel downstream of spillway
e. Other Comments	
Spillway Structure	The upstream portion of the spillway is concrete in good condition except for the previously mentioned tilted wall downstream of flashboards on the left side. The concrete does have shrinkage cracks present, and all joints are in need of sealant. There is a chain link fence across the entrance channel. The metal flashboard guides are in good condition and the flashboards appear to be adequate. The downstream across the spillway is open joint stone masonry. Voids are present in this wall. Probes were inserted to depths of 1 ft., 1-1/2 ft., 2-1/2 ft., 4-1/2 ft. and 2 ft. at different locations. A probe was inserted to a depth of 8 ft. below the left concrete wall. There are

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Whiting Pond Dam DATE: 4 Oct. 78

AREA EVALUATED	CONDITION
Spillway Structure (Cont.)	indications of seepage from the right and left side of the stone masonry wall but the flowing water in the channel precludes a definite determination.
Reservoir Drain	The intake to the drain is below pond level and not observable. It is reported that it has a cap which must be removed by a diver before operation. The valve and operator stem is buried behind the left entrance channel wall. Probing with geoligist pick did not locate stem. Discharge end of 12-inch pipe is through left downstream channel wall.
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	
Slope Conditions	Face of dam
Bottom Conditions	Not visible
Rock Slides or Falls	None observed
Log Boom	None, but entrance is covered with chain link fencing
Debris	None observed
Condition of Concrete Lining	Concrete walls are below water
Drains or Weep Holes	None observed
b. Intake Structure	
Condition of Concrete	Good
Stop Logs and Slots	2 sets, Left side upstream slot broken off at top
Controls	Two Valves downstream of dam; one for reportedly buried 6-in. pipeline and one for reportedly buried 8-in. pipeline
Conduits	The reportedly buried 6-in. and 8-in. pipelines to mill are not visible
General	Plans to block the intake structure with concrete since it no longer used were reported

APPENDIX B
LIST OF AVAILABLE DOCUMENTS AND PRIOR INSPECTION REPORTS

LIST OF AVAILABLE DOCUMENTS
WHITING POND DAM

DOCUMENT	CONTENTS	LOCATION
"Dike & Spillway Alterations", James E. Munroe, Sr., undated	Four drawings (24" x 32") of embankment plan and cross-sections and spillway details for 1959 repairs	Town Planner's Office North Attleboro Town Hall, North Attleboro, MA 02760
Summary inspection report prepared by Hayden, Harding & Buchanan, Inc., Boston, MA for the Bristol County Commissioners	Comments based on inspections made 4 November 1965, 14 November 1967 and 21 March 1968	Massachusetts Department of Environmental Quality Engineering, 100 Nashua Street, Boston, MA, and Appendix B-2
Inspection report prepared by Universal Engineering Corp., Boston, MA, for the Bristol County Commissioners	Inspection made on 3 July 1970	Massachusetts Department of Environmental Quality Engineering, 100 Nashua Street, Boston, MA, and Appendix B-3
Photographs of the 1974 repairs to the spillway and adjacent area	Twenty photographs of construction activities	North Attleboro Conservation Commission, 43 S. Washington Street, North Attleboro, MA 02760

BRISTOL COUNTY, MASS.

INSPECTION REPORT & DATA FOR DAMS

PREPARED FOR THE BRISTOL COUNTY COMMISSIONERS
BY HAYDEN, HARDING & BUCHANAN, INC., BOSTON, MASS.

Dam No. N.A. -1
Town: North Attleborough
Stream: Ten Mile River
Pond: Whiting Pond
Date: November 7, 1967
By: R.C.H.

Owner: Town of North Attleborough
His Address:
Function of Dam: Recreation & Process Water
Location & Access: Whiting Pond, Whiting Street, west of Mills on Broad Street.
USGS Quad. Attleborough Lat. 41° 59' 40" Long. 71° 20' 05"

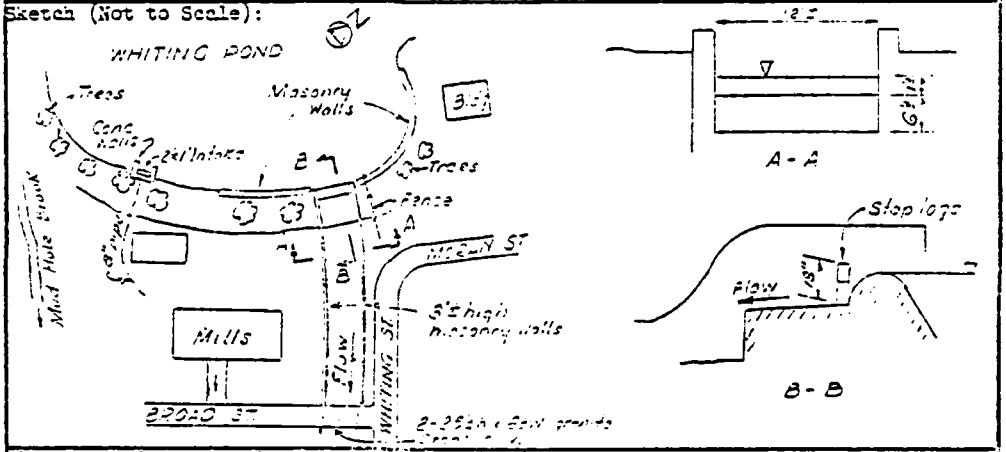
CONDITION RATING
Structural: Poor
Hydraulic: Poor
General: Poor
PRIORITY: Urgent 3

Drainage Area: 4.4 sq.mi.; Ponds: ___ ac.; Res. & dam: ___ ac.
Character of B.A. Gently sloping with little storage
Estimated (Floods estimated at Washington St. inclusive of Discharge flow in bypass creek)
Capacity Spillway Q= 3.33x12'(0.5)1.5 approx. 14 cfs. (116 cfs)

KIENISON-COLBY FLOODS
Minor: 295 cfs
Major: 555 cfs
Rare: 955 cfs
Maximum: 1450 cfs

General Description of Dam and Discharge Control: Overgrown earth embankment. Small 12' wide spillway at north end of concrete with 18" stoplogs. About 18" freeboard.

Sketch (Not to Scale):



Remarks and Recommendations: Sanitation Department must at present siphon off high water - grossly inadequate discharge provisions. Overtopping was reportedly avoided in 1955 by placing sandbags on embankment. Some damage, however, from flooding of Mud Hole Brook on south side of mill. Great damage potential if embankment is overtopped in flood.

Discharge inadequate. Recommend provision of wider, deeper spillway and gate.

Re-Inspection	Date	By	Comment
	11-14-67	WEL	Change Priority 1 to 3 Conc. weir removed.
	3-21-68	JMS	Some eroding - OK

Dam No. NA-1

BRISTOL COUNTY, MASS.
INSPECTION REPORT FOR DAMS

PREPARED FOR THE BRISTOL COUNTY COMMISSIONERS
BY UNIVERSAL ENGINEERING CORP., BOSTON, MASS.

DAM NO. N.A. - 1
TOWN: North Attleboro

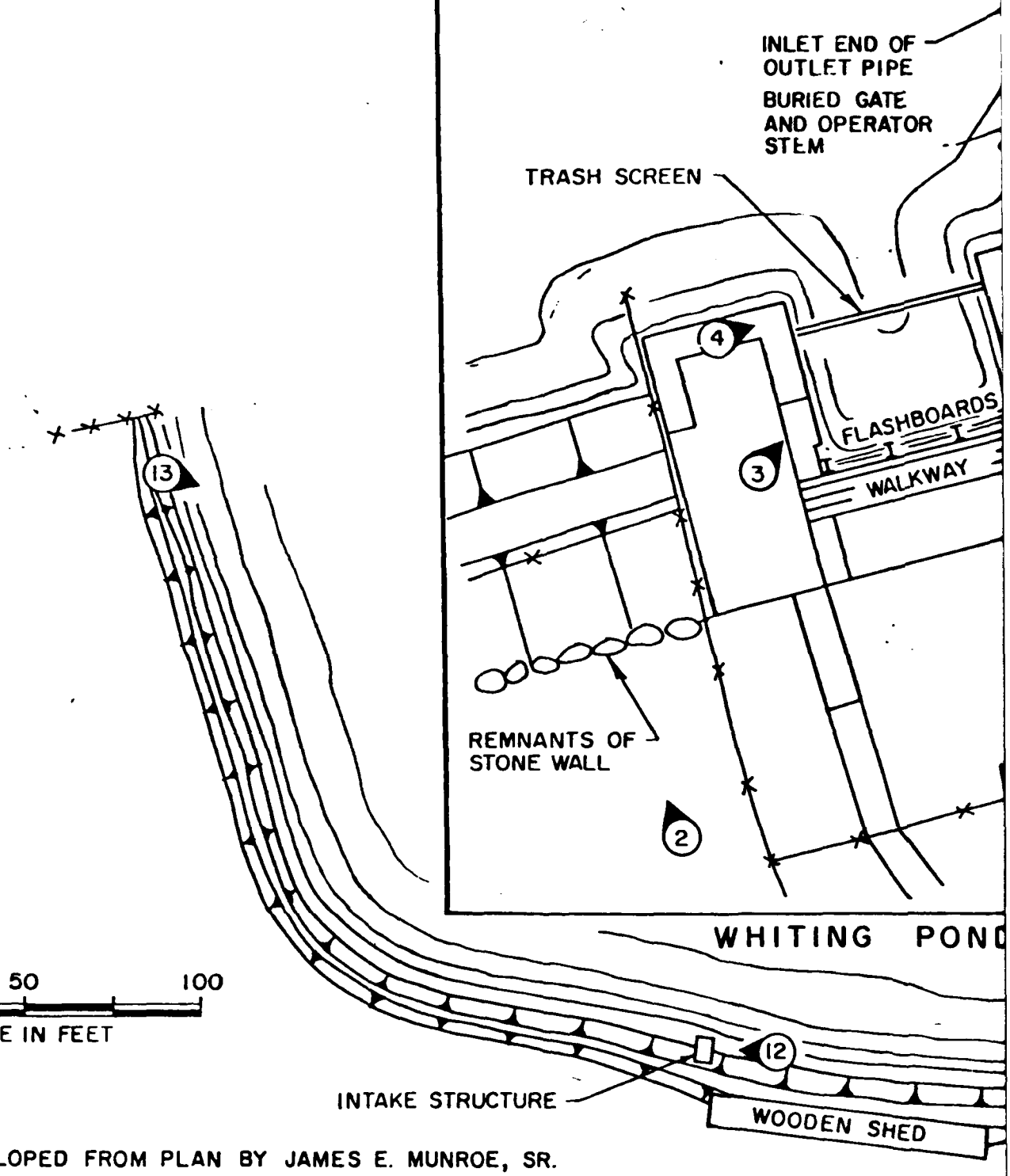
INSPECTION DATE	REMARKS & RECOMMENDATIONS
7-3-70	The crest of the concrete weir was not visible. There is presently a low flow over the stop logs and there is considerable leakage between and under them. A chain link fence on the upstream side is acting as a trash rack and is in good condition. A 3" freeboard is available, based on the remaining length of the stop log guides. Recommend that the downstream channel be cleaned, the masonry face of dam be pointed, the stop logs and timber guides be replaced, and the guides be extended to top of the abutment to gain 18" more freeboard. Consideration should be given to increasing the height of the embankment due to reported overtopping in the past.

Supplement to original report and data by Hayden, Harding & Buchanan, Inc.

DAM NO. N.A.1

APPENDIX C
SELECTED PHOTOGRAPHS OF PROJECT

SPILLWAY DETAIL (SC



OTE:

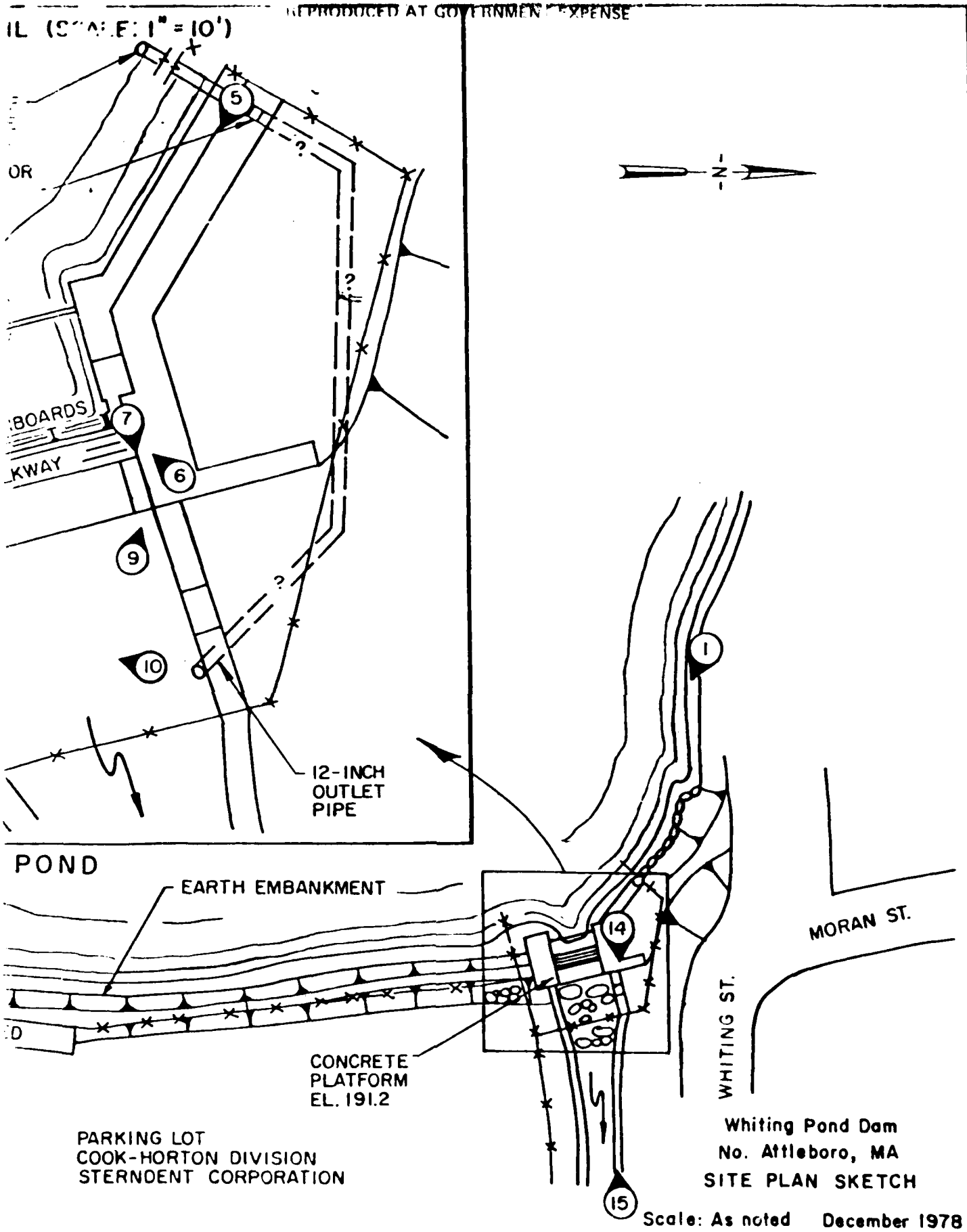
LAN DEVELOPED FROM PLAN BY JAMES E. MUNROE, SR.
ND FIELD OBSERVATIONS ON 4 OCTOBER 1978

EGEND:

(5) PHOTO NUMBER AND DIRECTION OF VIEW

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

16/2

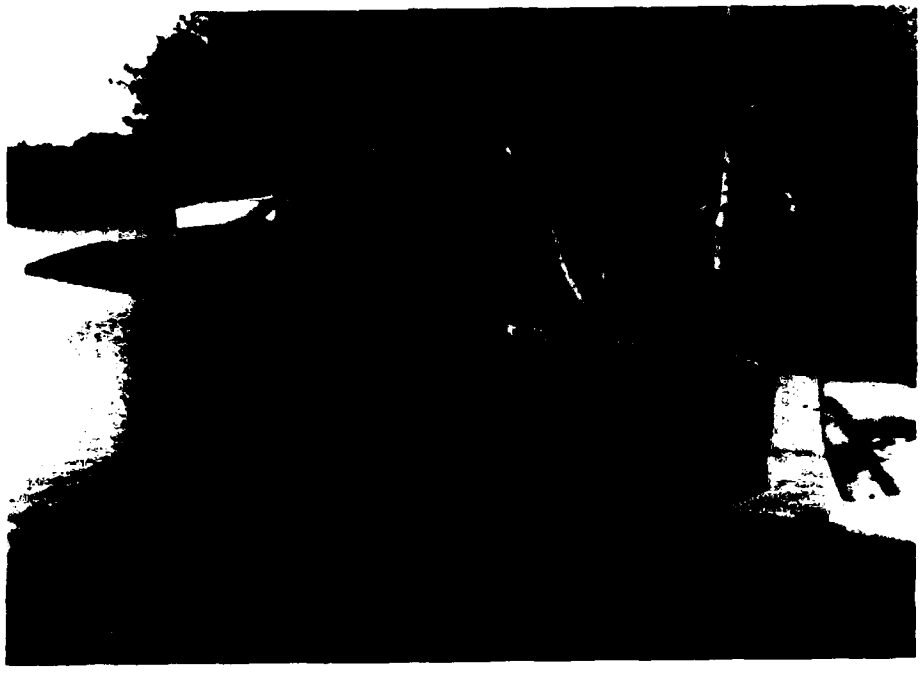


PARKING LOT
COOK-HORTON DIVISION
STERNDENT CORPORATION

Whiting Pond Dam
No. Attleboro, MA
SITE PLAN SKETCH

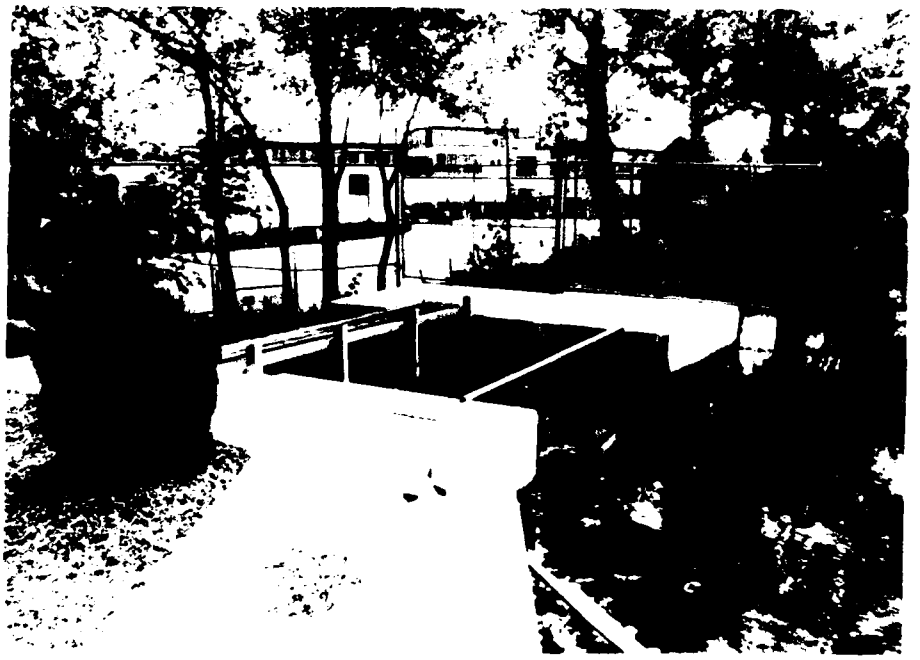
Scale: As noted December 1978

2. Remnants of stone wall right of spillway structure

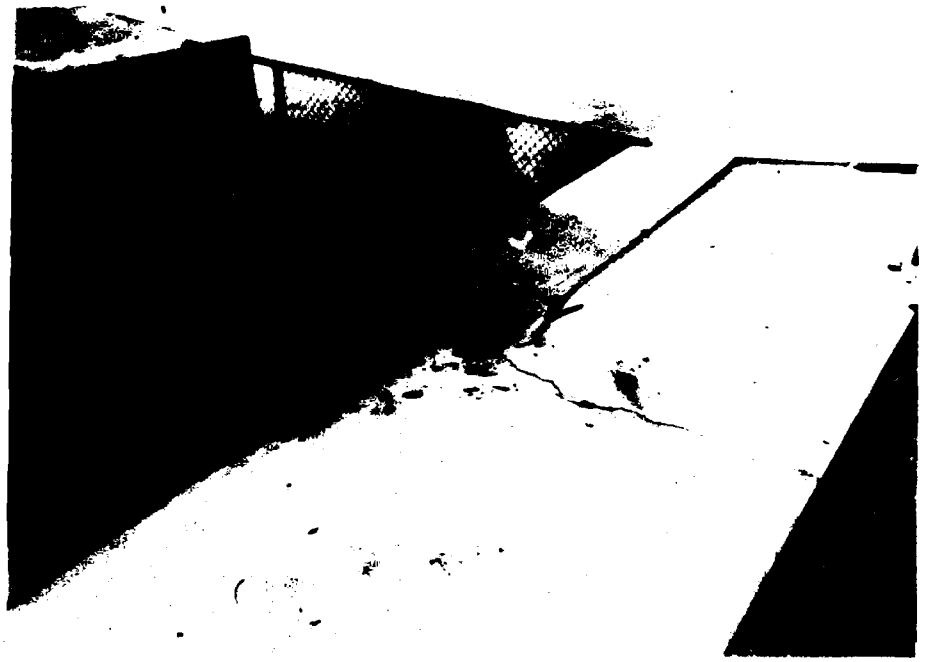


3. Left embankment

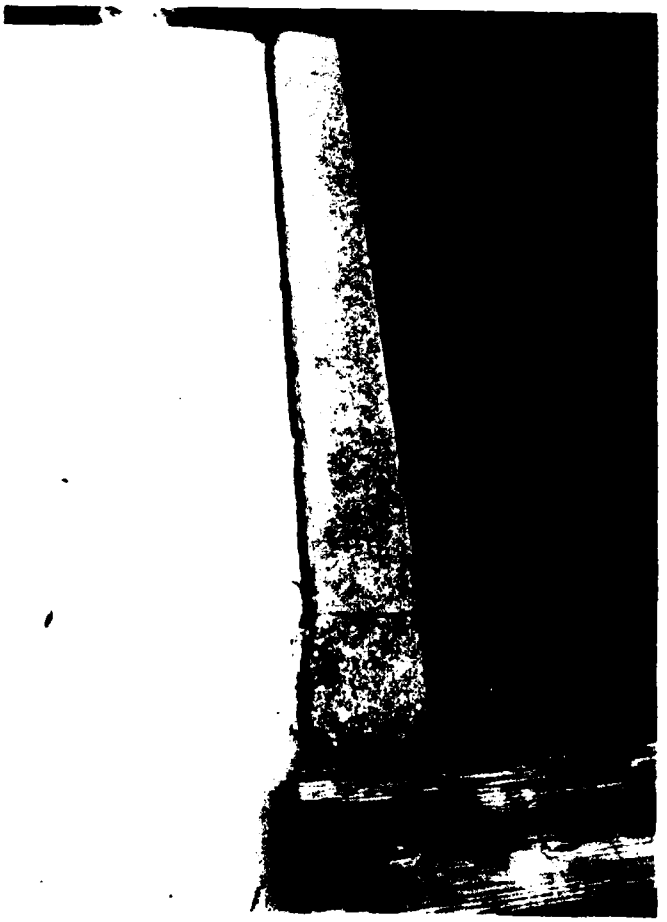
4. Left spillway walls and adjacent platform



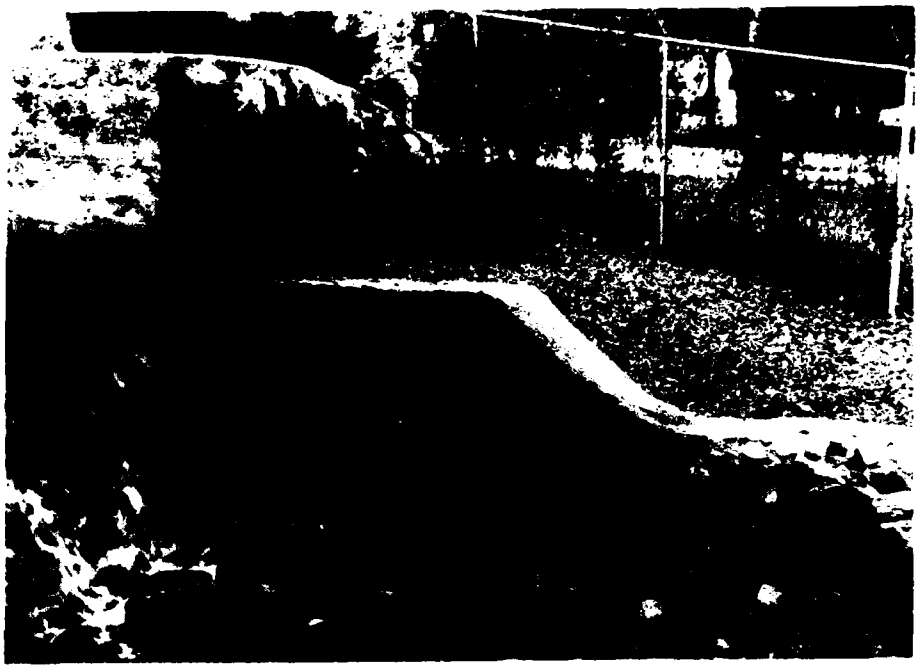
5. Right spillway walls and adjacent platform



6. Service bridge bolted to older concrete walls



7. Older left spillway wall has tilted

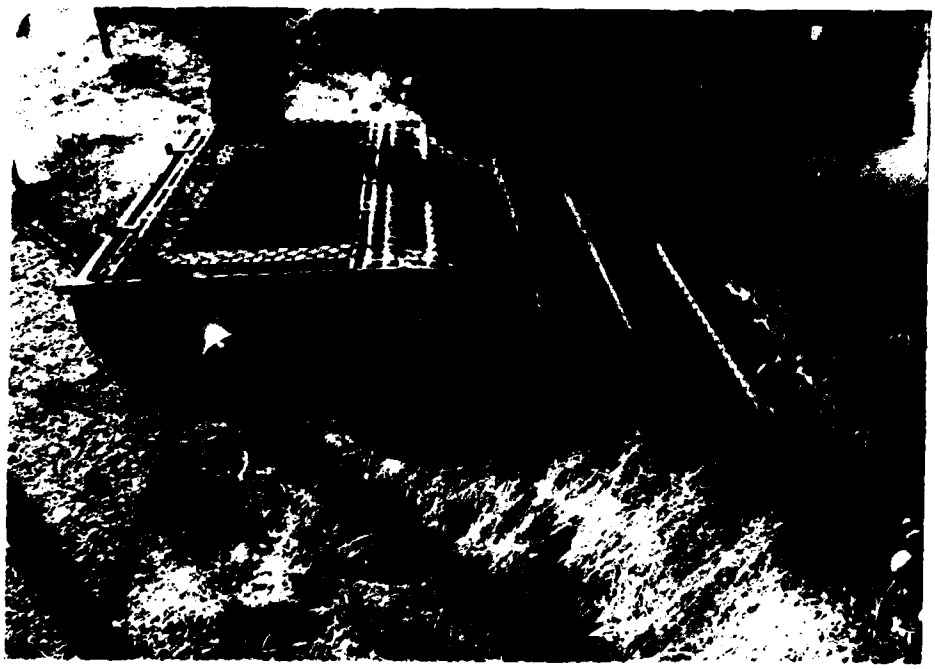


8. Masonry wall at left side of downstream end of spillway and outlet of reservoir drain

9. Void extending under left spillway wall

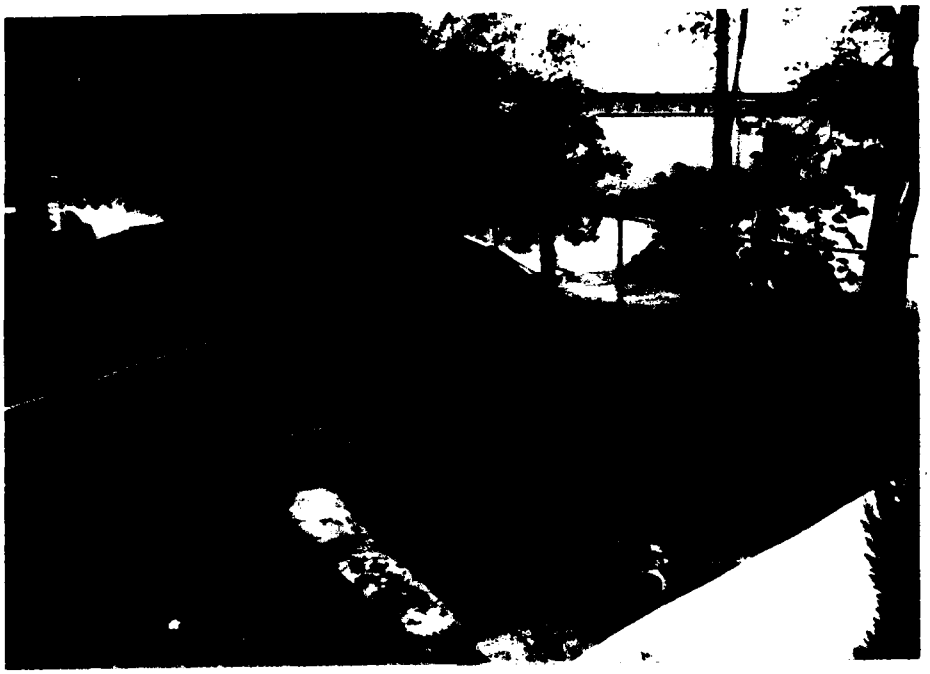
10. Masonry wall at right side of downtream end of spillway

11. Probe in void in right stone masonry end wall



12. Intake structure approximately 250 ft. right of spillway

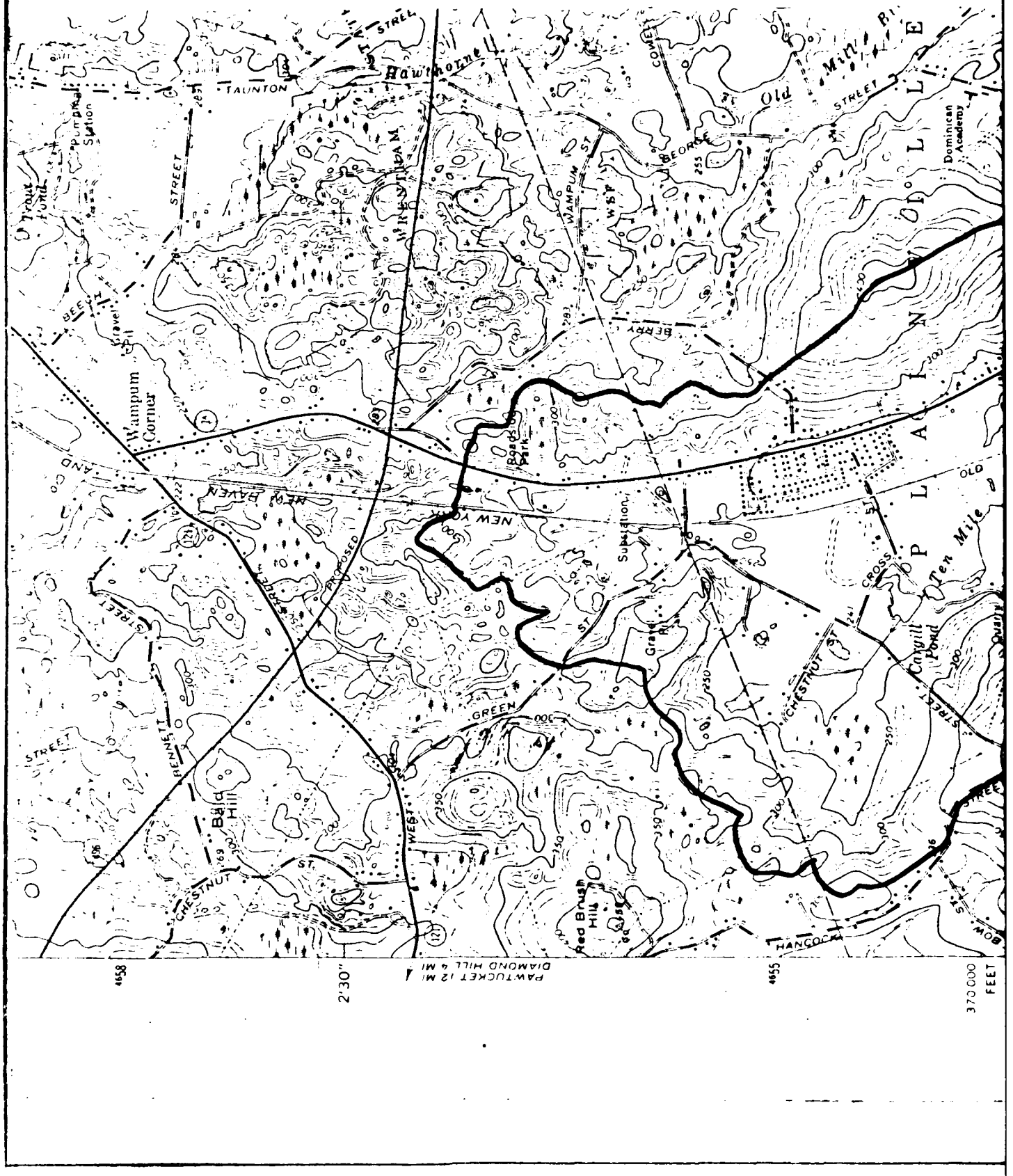
13. Overview of upstream face of dam

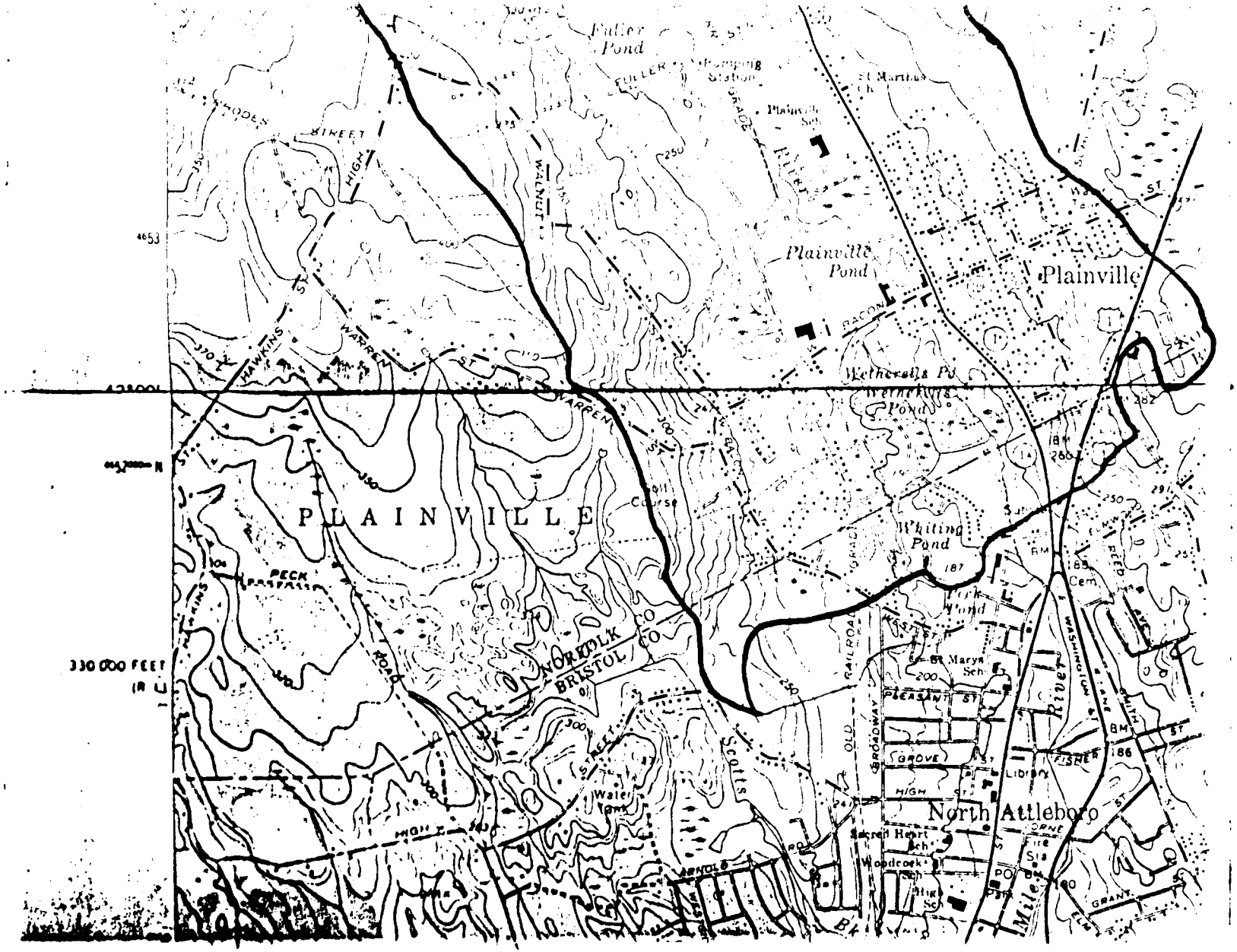


14. Downstream channel from spillway

15. Downstream channel showing spillway structure

APPENDIX D
OUTLINE OF DRAINAGE AREA AND HYDRAULIC COMPUTATIONS





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N

WHITING POND DRAINAGE AREA
Scale: 1:24,000

D-1

REPRODUCED AT GOVERNMENT EXPENSE

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Size and Hazard Classification

Size Classification

Elevation of Top of Dam: 191.2 ([illegible])
Elevation of Sp. Way Crest: 187
Approximate Elevation of ℄ of Pond: 182.4

Storage = $\frac{1}{3}$ (4.6 x 193) + $\frac{1}{2}$ (193+67) 4.2 ≈ 211

Height of Dam = 8.8 ft (Approximate)

211 Acre-ft < 1000 Acre-ft
8.8 feet < 25 feet

Size = SMALL

Hazard Classification

Because of the location of the Edward N. Cook Plate Division ([illegible] Corporation), the Turners Power Plant, and the dense residential district downstream of the dam, the hazard will initially be assumed as HIGH.

Drainage Area

Approximately 4.10 mi². [illegible] Pond, as shown on the U.S.G.S. quadrangle, is actually called The [illegible] and is not connected to Winning Pond.

Historical Floods

No elevations of the water surface in Winning Pond for the 1955 hurricane were available. However, the dam had to be sandbagged during this storm to prevent overtopping. **Dam damaged in April of 1974** due to seepage action.

Test Flood

For "Small" size and "High" Hazard:

Use [illegible]

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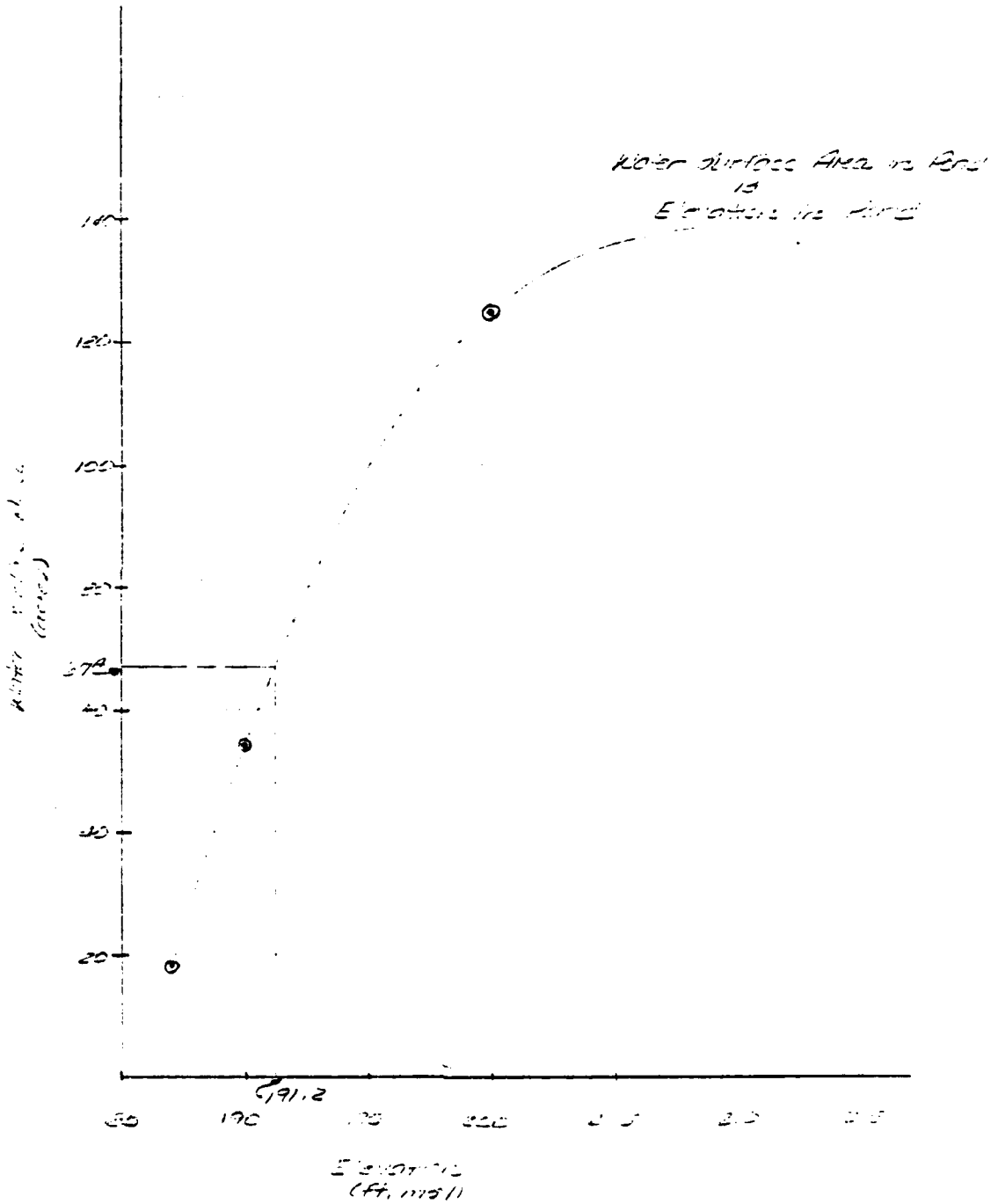

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Solution of PMF

Slope: Watercourse Characteristics
7700 feet overland Flow
12500 feet stream Flow

Overland Flow: $\frac{320-230}{7700}$ = 0.011688
≅ 1.1688 %

Stream Flow: $\frac{230-187}{12500}$ = .00344
≈ .344 %

Time of Travel:
Overland Flow: $\frac{7700'}{.375 \text{ f/s}}$ = 20533 s = 5.7 hour

Stream Flow: $\frac{12500'}{.95 \text{ f/s}}$ = 13158 s = 3.7 hours

∴ Tc = 9.4 hours

Lag time = 0.6 Tc = 0.6 × 9.4 = 5.64 hrs

ΔD = 0.4L

ΔD = 2.26 hours , 7ΔD = 15.80 hours

CN Analysis

Hydrologic Group B/C

Land Use	Area	CN	CN X Area
Water, Surface	80	100	8000
Swamps	70	98	6860
Forest	1659	71	117789
Open spaces	310	74	22940
Road	55	98	5390
Residential	450	79	35550
	2624		196529

Weighted CN = 74.9 say 75

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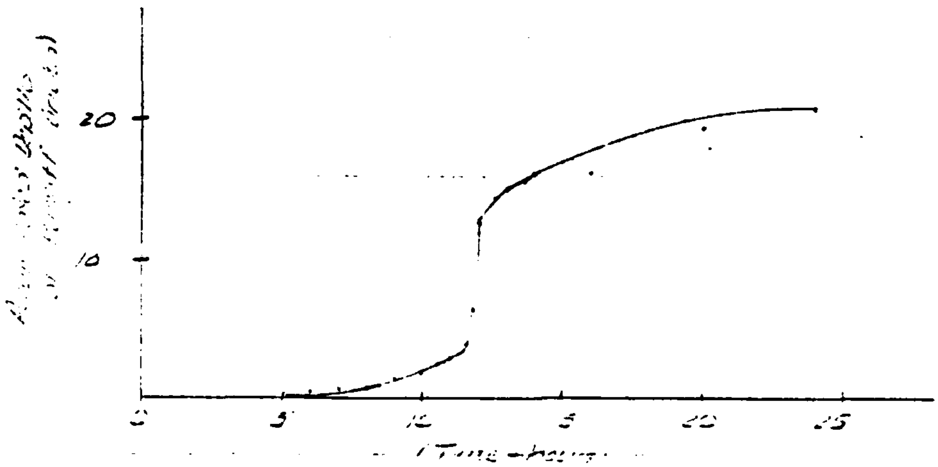
$S = \frac{1000}{75} - 10 = 3.3\bar{3}$

Precipitation = 24 inches in 24 hours

Time (hours)	P_x/P_{24}	Upper P (inches)	Lower Q (inches)
0	0	0	.17
2	.022	.59	.01
4	.043	1.15	.06
6	.080	1.92	.32
7	.100	2.40	.59
8	.120	2.83	.83
9	.147	3.53	1.32
10	.181	4.34	1.93
10.5	.204	4.90	2.37
11	.235	5.64	2.93
11.5	.283	6.79	3.97
11.75	.387	9.29	6.22
12	.663	15.91	12.51
12.5	.735	17.64	14.19
13	.772	18.53	15.06
13.5	.797	19.13	15.64
14	.820	19.68	16.13
16	.880	21.12	17.59
20	.952	22.85	19.29
24	1.000	24	20.42



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.33 - 3.5 (2.33) = 1.71 hours (starting time)

Increment	Time (hours)	Mass Runoff	ΔQ	Δq cfs	Y	YΔq (cfs)
	.71	.06				
ΔQ_1			0	0	0.2	0
	3.97	.30				
ΔQ_2			.57	175	0.4	70
	6.23	.65				
ΔQ_3			.35	103	0.6	62
	8.49	1.00				
ΔQ_4			1.50	440	0.8	352
	10.75	2.50				
ΔQ_5			12.50	3663	1.0	3663
	13.01	15.00				
ΔQ_6			2.00	586	.667	391
	15.27	17.00				
ΔQ_7			2.00	586	.333	195
	17.53	19.00				
						4753 cfs

$$\Delta q = \frac{555 \times 4.1}{\frac{2.25}{2} + 5.33} \Delta Q = 293\, \Delta Q$$

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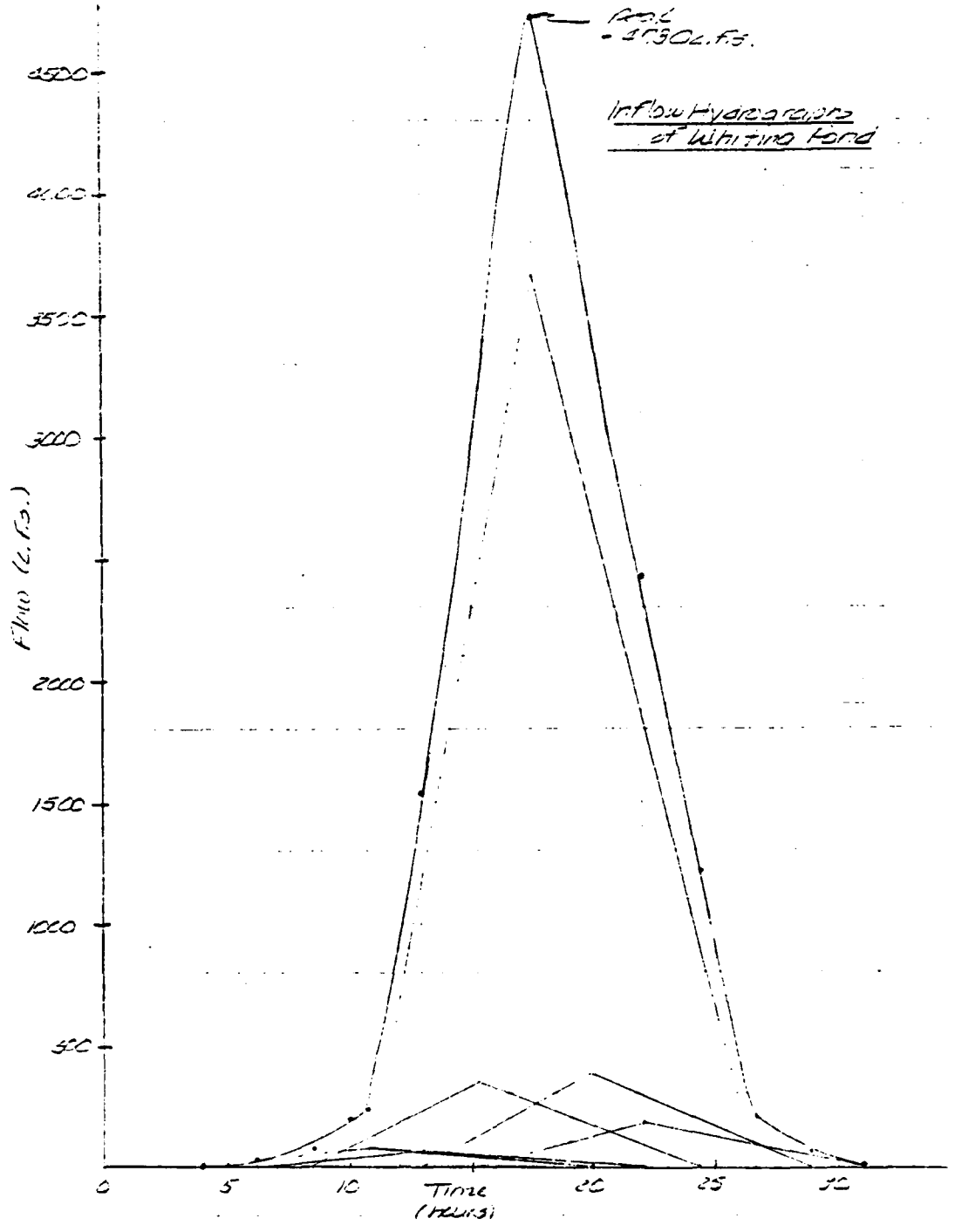

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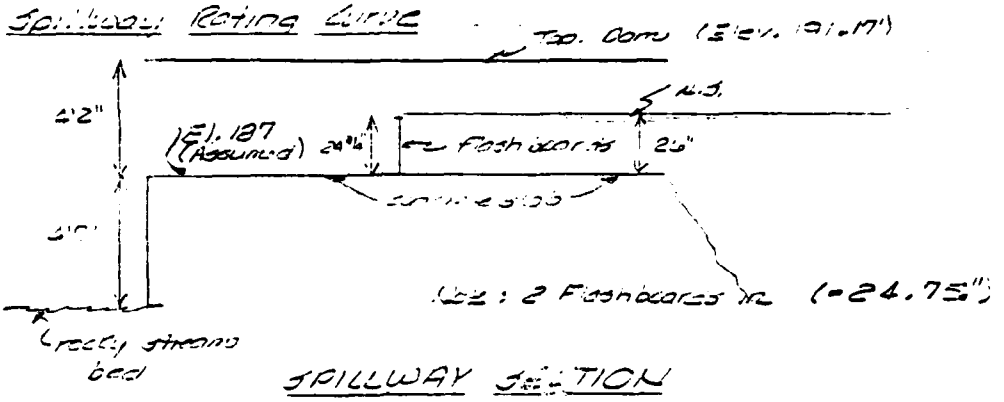
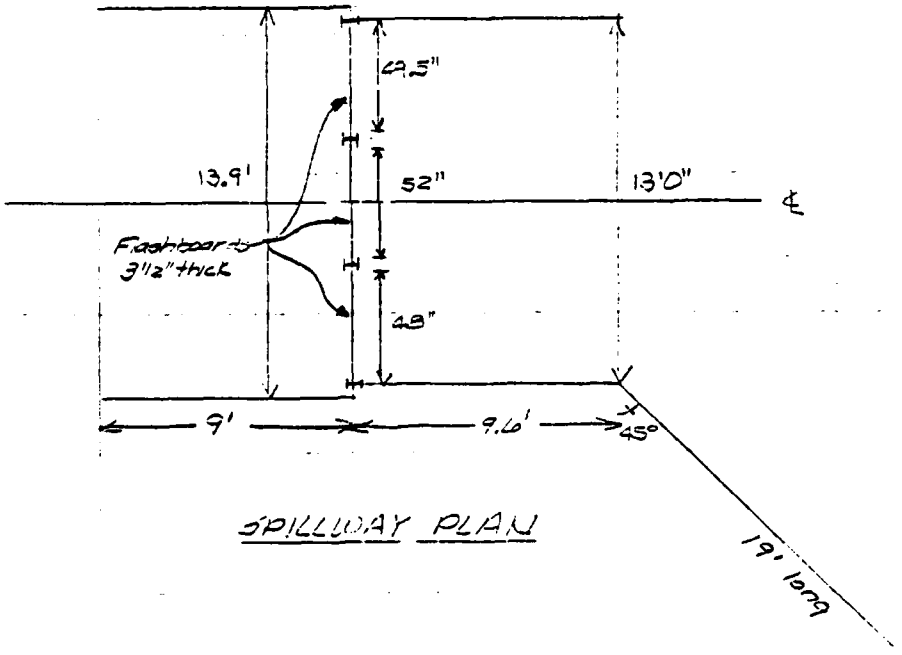
Spillway Rating Curve



(Lz : 2 Flashboards Ht (=24.75")

SPILLWAY SECTION



SPILLWAY PLAN

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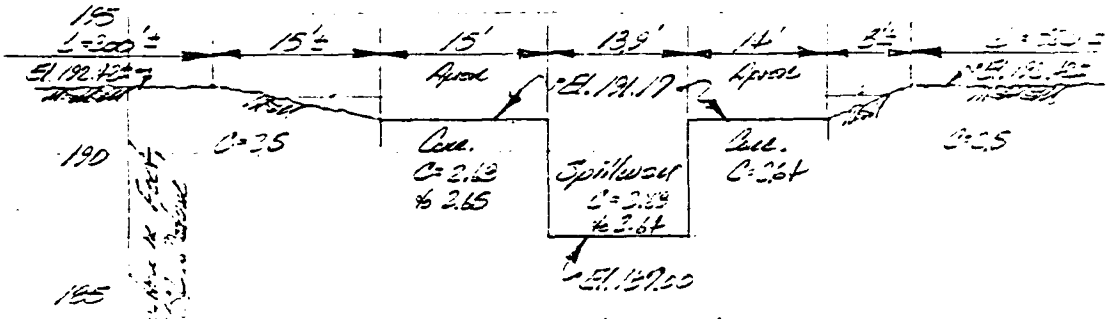
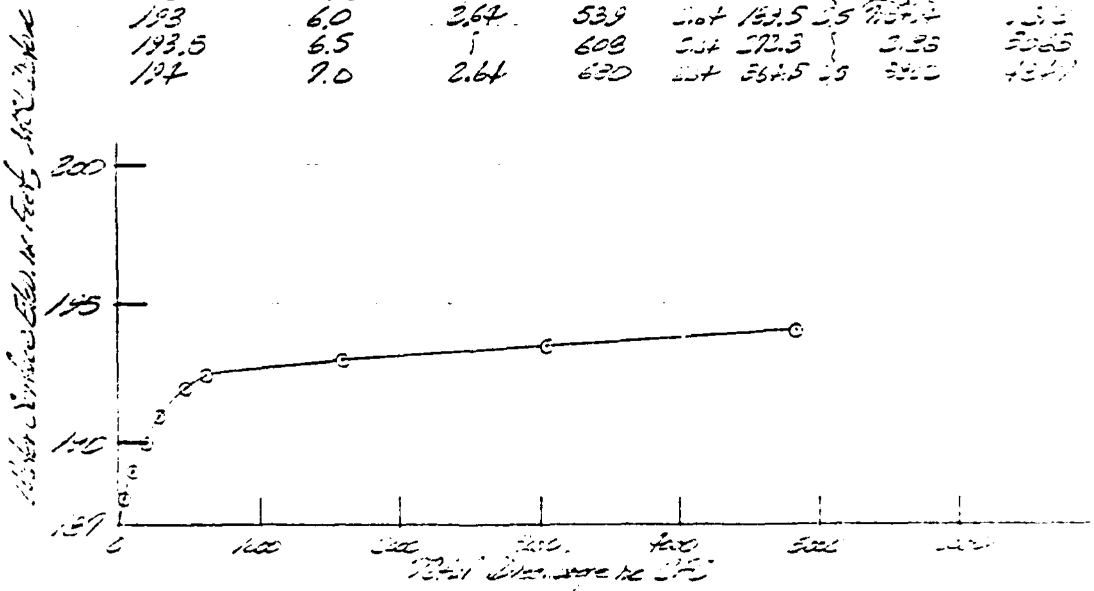


Spillway & Dam Section Looking Downstream

Spillway Rating Curve - No Flashboards In L spillway = 13.9'

Water Surface Elev.	Head on Spillway	"C" Spillway	Q Spillway	Q Aprons			Q Earth Dam	Q Total
187	0.0	—	0					0
188	1.0	2.62	37.2 cfs					37.2
189	2.0	2.64	103.3					104
190	3.0		190.7					[illegible]
191	4.0		294					[illegible]
191.17	4.17		312	—				[illegible]
192	5.0		410	2.60	53.3	2.5	15.1	[illegible]
192.42	5.42		463	2.63	108.6		[illegible]	[illegible]
193	6.0	2.64	539	2.64	183.5	2.5	[illegible]	[illegible]
193.5	6.5		608	2.64	272.3		[illegible]	[illegible]
194	7.0	2.64	680	2.64	364.5	2.5	[illegible]	[illegible]



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DETAIL [illegible] Pond

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Estimating Effect of Surcharge Storage on Maximum Probable Discharge.

1. Q_{p_1} = 4730 cfs

2. Surcharge Height:

Elev. = 193.97
H = 6.97 feet

Volume of Storage = $\frac{6.97 \times 92}{4.1 \text{ sq.mi} \times 53.3}$ = 2.93 inches of runoff

Q_{p_2} = 4730 cfs $\left(1 - \frac{2.93}{2?}\right)$ = 4152 cfs

3. Surcharge Height:

Elev. = 193.81
H = 6.81

Volume of Storage = $\frac{6.81 \times 90.5}{4.1 \text{ sq.mi.} \times 53.3}$ = 2.82 inches of runoff

Avg. Stor = 2.88 inches of runoff

Q_{p_2} = 4162 cfs, say 4160 cfs

At elev. = 193.81 ft. msl.

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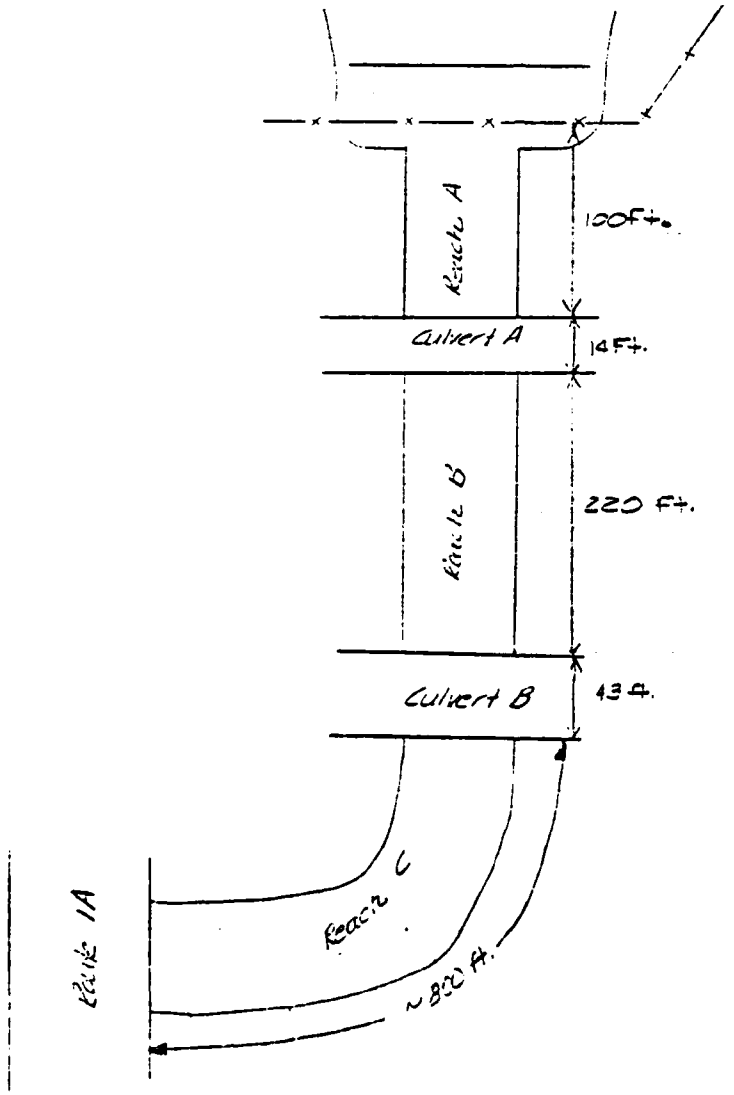
Schematic of Downstream Channel System



Dam Failure Analysis

1. S at time of failure = 211 Acre-ft

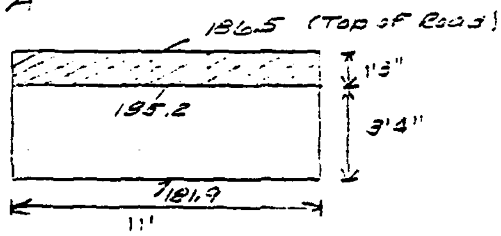
2. $Q_{p1} = \frac{8}{27} W_b \sqrt{g} \, Y_o^{3/2}$

Y_o = 8.8 feet
W_b = 0.40 (300) = 120 feet

$Q_{p1} = \frac{8}{27} \times 120 \sqrt{32.2} \, (8.8)^{3/2} \doteq 5267$ cfs

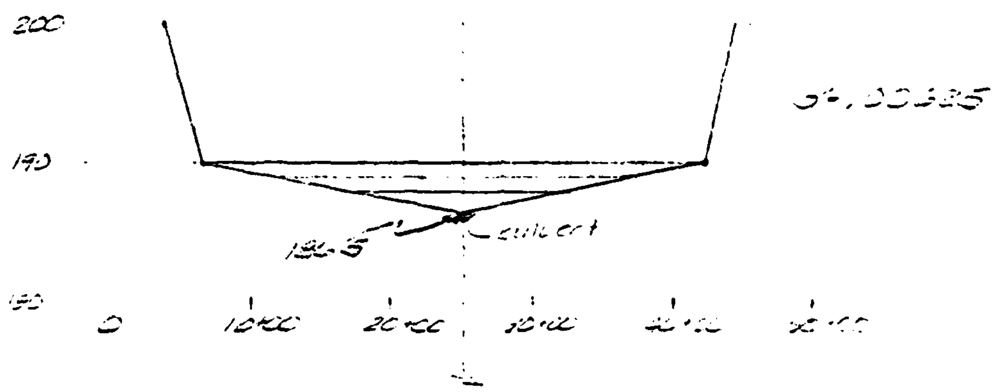
First Reach - Paved Driveway into the back lot of Edward W. Cook Plate Division

Culvert A



n factor = .030

Cross Section of Overland of Culvert.



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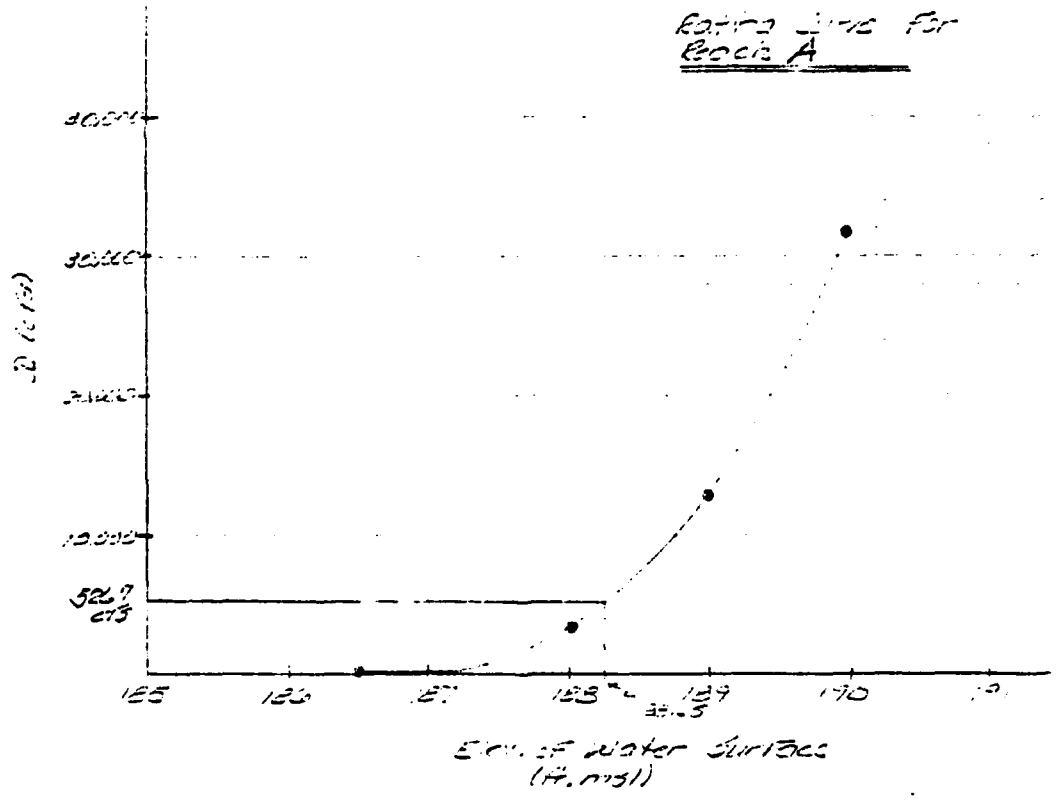
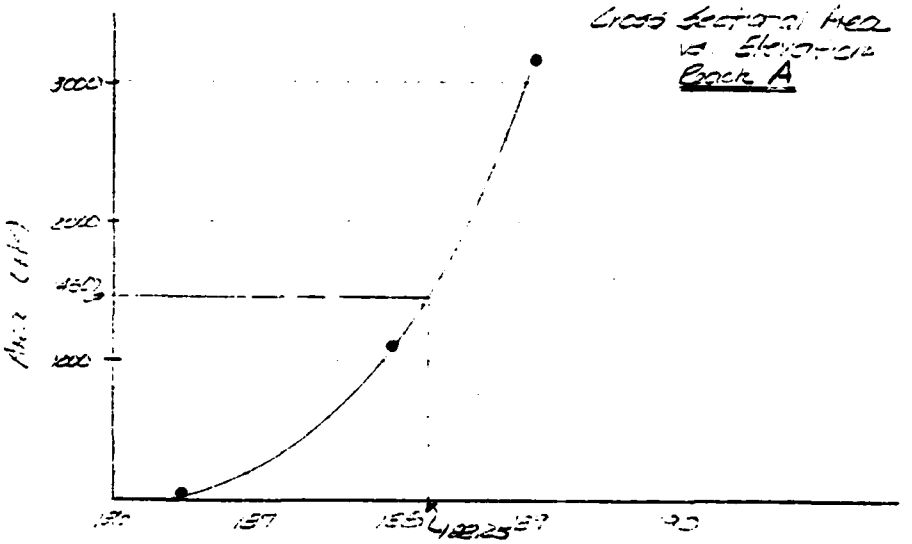
Overland Free Flow Capacity

Elev. of water surf. (Ft msl)	Area (over crit.) (Ft^2)	W.P. (Ft)	R (Ft)	Q over crit (cfs) $n=0.035$	ΔH approx. (Ft)	Q pressure (cfs) $C=0.82$	Q Total
186.5	——	——	——	~0	1.25	270	270
188.0	1078	1430	0.754	3390	3.8	403	3793
189.0	3139	2500	1.256	17236	3.8	470	17706
190.0	6302	3550	1.775	31016	4.3	529	31545



Cross Sectional Area vs Elevation
Basin A



$Q_{p_1} = 5267$ cfs

$V_1 = \frac{120' \times 1250 \text{ sq. ft.}}{43,560} \approx 4$ Acre-ft.

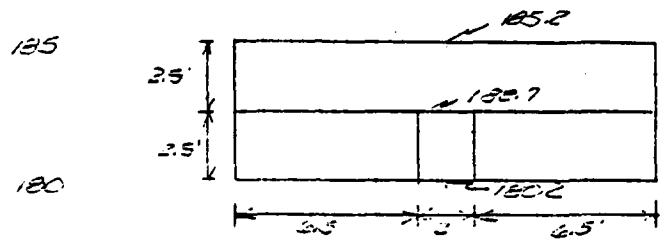
$5267 \left(1 - \frac{4}{211}\right) = 5167 = Q_{p_2 \text{ total}}$

$V_2 = \frac{120' \times 1400 \text{ sq. ft.}}{43,560} = 3.86$ Acre-ft

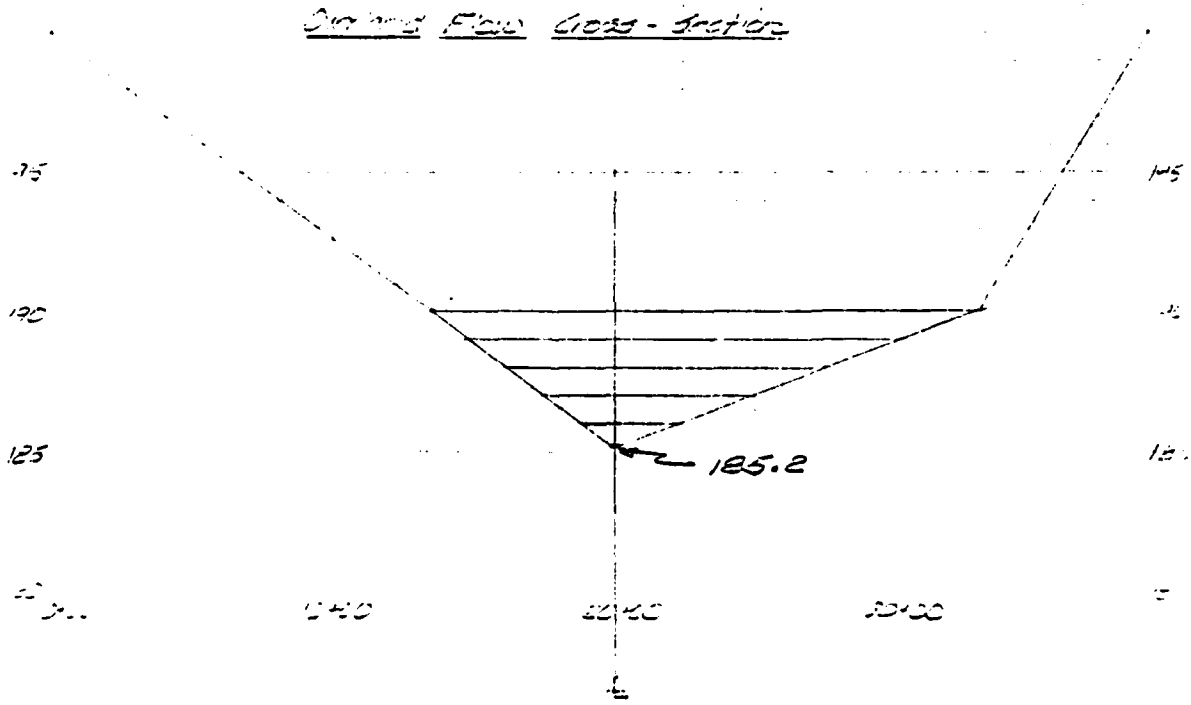
$\frac{V_1 + V_2}{2} = 3.93$ Acre-ft

$Q_{p_2} = 5267 \left(1 - \frac{3.93}{211}\right) \approx \underline{\underline{5170 \text{ cfs}}}$

Storm Roads - Culvert B

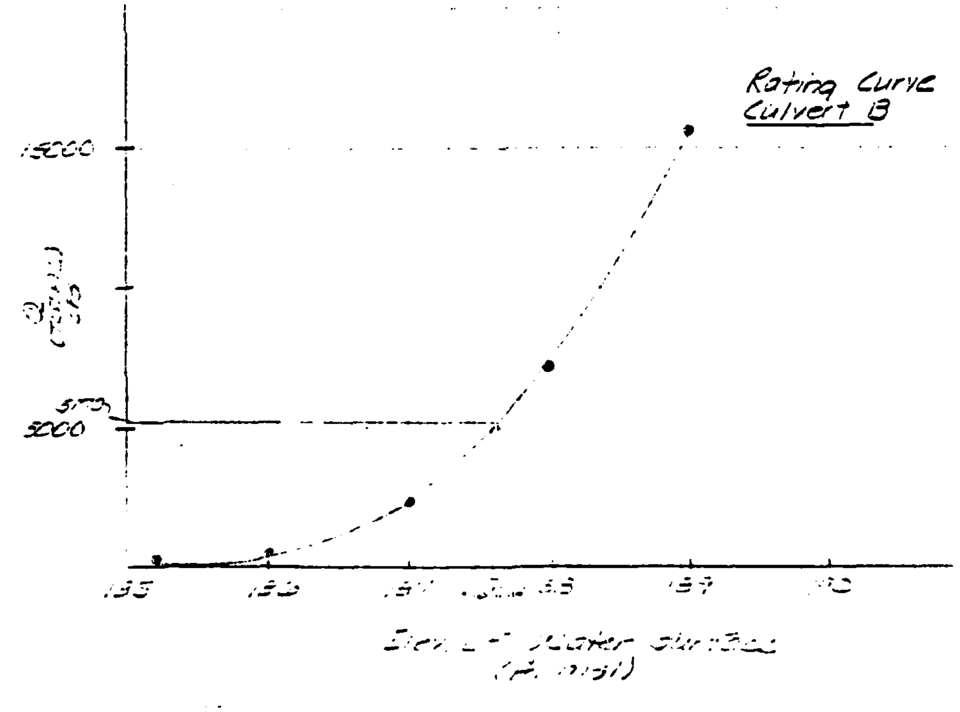


Storm Flow Cross-Section



Overland and Pressure Flow Calculations

Elev of Approach (ft msl)	Area (overland) ft2	WP (ft)	R (ft)	Q (overland) (cfs) n=.035	ΔH approx. (ft)	Q pressure (cfs) C=0.80	Q total (cfs)
[illegible]				~0	3.5	330	330
[illegible]	122	[illegible]	.4176	[illegible]	3.3	380	646
[illegible]	[illegible]	740	.9189	2157	4.3	433	2590
[illegible]	[illegible]	[illegible]	1.4133	[illegible]	5.3	480	7274
[illegible]	2717	1500	1.9191	[illegible]	6.3	524	15648
190.0	[illegible]	1950	2.4 55	28529	7.3	564	29093



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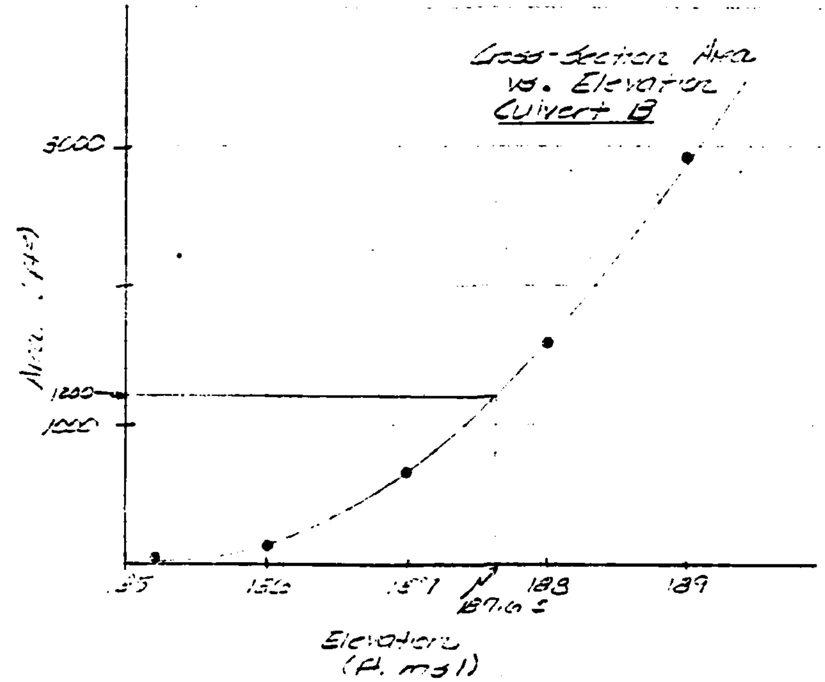

$Q_{p1} = 5170$

$V_1 = \frac{220' \times 1200 ft^2}{43560} = 6.1$ Acre-feet

$Q_{p2\,TRIAL} = 5170 \left(1 - \frac{6.1}{211}\right) \doteq 5020$ cfs

$V_2 = \frac{220' \times 1180 ft^2}{43560} = 5.96$

$\frac{V_1 + V_2}{2} = 6.03$ Acre-feet

$Q_{p2} = 5170 \left(1 - \frac{6.03}{211}\right) \cong 5022$ cfs

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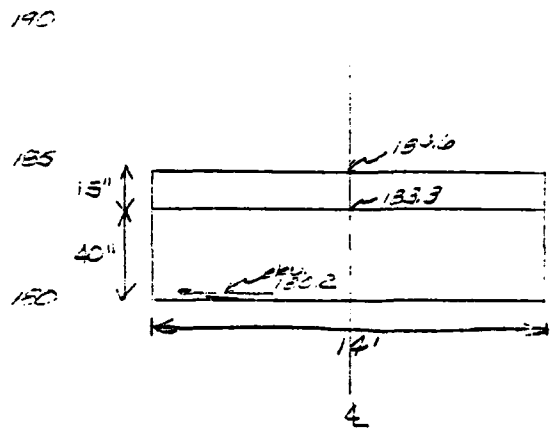
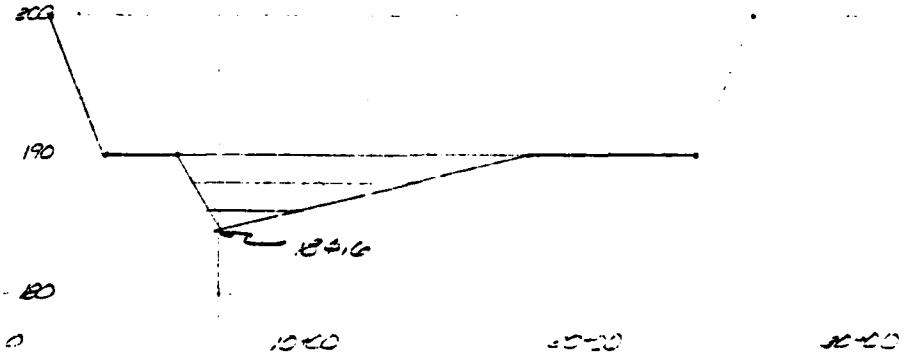
Tire Rock "C" Culvert at Route 1A
-200 feet downstream of Second Rock Culvert



Channel
Cross-Section



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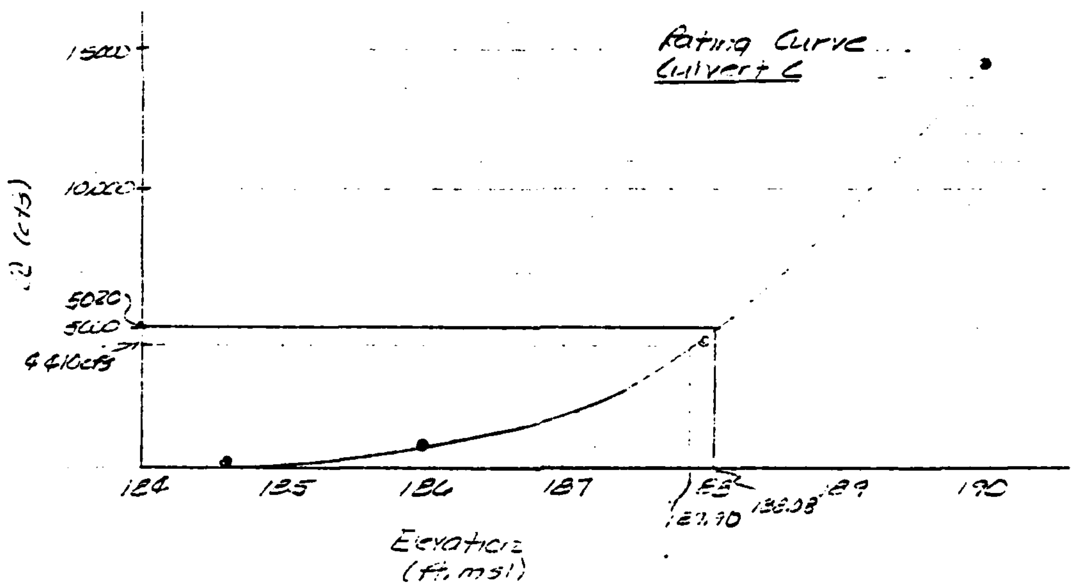
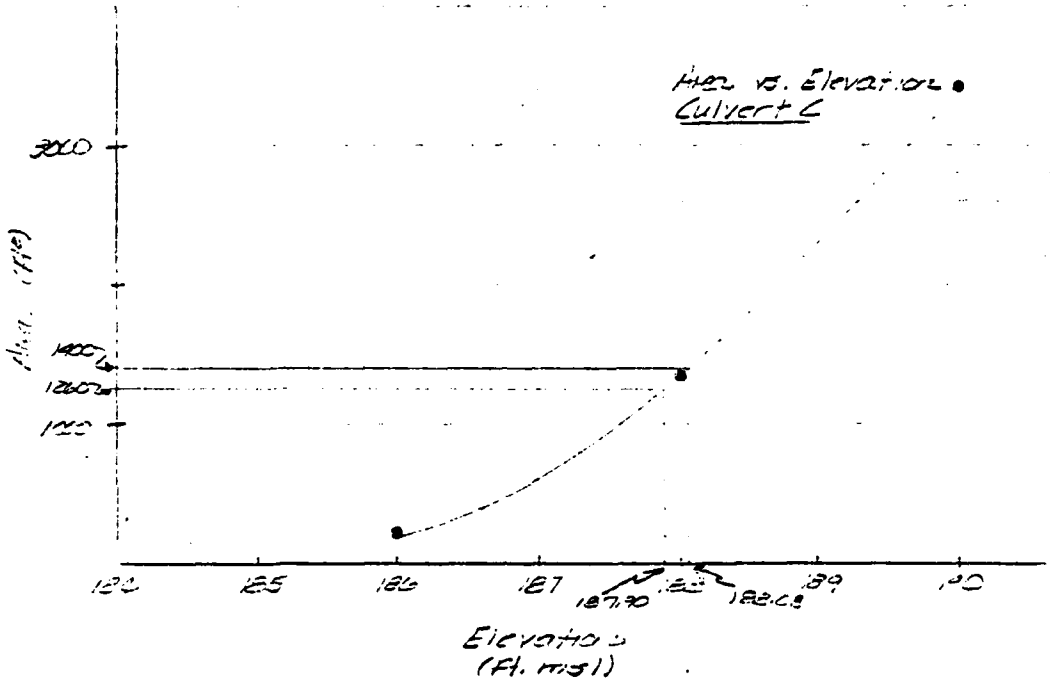
Overland and Pressure Flow Calculations

Elev. of Water Surf. (ft msl)	Area (overland) ft²	WP (ft)	R (ft)	Q (overland) (cfs) ~ n=.035	ΔH approx. (ft)	Q pressure (cfs) ~ C=.75	Q total (cfs)
184.6					1.3	320	320
186	227	310	.732	378	2.7	461	839
188	1333	770	1.731	3939	4.7	609	4548
190	3413	1250	2.730	13668	6.7	727	14395

treat as short tube although it really isn't.

[illegible]





$Q_{D1} = 5022$ cfs.

$V_1 = \frac{800' \times 1400\ ft^2}{43560} = 25.71$ Acre-ft

$Q_{D2\ TRIAL} = 5022\ cfs\left(1 - \frac{25.71}{211}\right) = 4410$ cfs

$V_2 = \frac{800' \times 1260\ ft^2}{43560} = 23.16$ Acre-ft

$\frac{V_1 + V_2}{2} = \frac{25.71 + 23.16}{2} = 24.43$ Acre-ft

$Q_{D2} = 5022\ cfs\left(1 - \frac{24.43}{211}\right) = 4440$ cfs.
elev. 187.92 feet

APPENDIX E
INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR. DIST.	STATE	COUNTY	CONGR. DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY MO YR
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	10				WHITING POND DAM	4157.7	7120.1	06DEC78

POPULAR NAME	NAME OF IMPOUNDMENT
	WHITING POND

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
[illegible]	[illegible]	TEN MILE RIVER	NORTH ATTLEBORO	0	19120

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
[illegible]	1900	R	9	6	211	29	NED	N	N	N	N	21FEB79

REMARKS

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	[illegible]	C	15	410	5000											

OWNER	ENGINEERING BY	CONSTRUCTION BY
TOWN OF NORTH ATTLEBORO		ROBERT [illegible]

REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
[illegible]	NONE	NONE	MA DPW

INSPECTION BY	INSPECTION DATE DAY MO YR	AUTHORITY FOR INSPECTION
HALEY + ALDRICH, INC.	06OCT78	PUBLIC LAW 92-367

REMARKS
AS-1970 REPAIRS TO SPILLWAY STRUCTURE ONLY

END

FILMED

7-85

DTIC